A young boy in a red shirt and grey shorts is riding a blue and black bicycle on a paved path. He has a black backpack. The path is next to a body of water. In the background, there are modern houses with solar panels on their roofs. The scene is bright and sunny.

Paving the way towards a harmonised Carbon Accounting Approach for the Financial Sector

A report by the Platform Carbon Accounting Financials (PCAF)

PCAF

Platform Carbon Accounting Financials

Paving the way towards a harmonised Carbon Accounting Approach for the Financial Sector

The Platform Carbon Accounting Financials, or PCAF, was created by a group of Dutch financial institutions which have joined forces to improve carbon accounting in the financial sector and to create a harmonised carbon accounting approach. At COP21 in Paris, these members co-authored the Dutch Carbon Pledge, urging global leaders to take effective measures to keep global warming within safe levels. The group shares its findings with other interested parties to encourage others to adopt carbon accounting as a positive step towards a low carbon economy.

PCAF consists of the following members:



ABN AMRO



Achmea Investment Management



ACTIAM



APG



ASN Bank



FMO



MN



PGGM



Stichting Pensioenfonds Metaal en Techniek (PMT)



Stichting Pensioenfonds van de Metalektro (PME)



Triodos Bank



De Volksbank

This report was commissioned by PCAF and compiled, edited and reviewed by Ecofys
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Executive summary

Triggered by the Paris Agreement at COP21 in December 2015, more and more financial institutions are assessing the climate-related impact of their portfolio. In recent years, several initiatives have been launched to understand the environmental impact of financial performance and to encourage policy and investment practices to address long term risks of climate change. Some of these initiatives, including legislative changes, have resulted in a carbon footprinting trend for investment portfolios and a rising need for transparency and uniformity of footprinting methods. Although some harmonisation attempts have been made, no standard has emerged yet.

At the end of 2015, eleven Dutch financial institutions joined forces to improve carbon accounting through the Platform Carbon Accounting Financials (PCAF) by increasing transparency and uniformity in carbon footprinting and target setting. The founding members of PCAF are banks (ABN AMRO, ASN Bank, de Volksbank and Triodos Bank), asset owners (PME and PMT), asset managers (ACTIAM, APG, MN, and PGGM) and a development bank (FMO). At the COP21 in Paris, these members published the Dutch Carbon Pledge, committing to calculate their carbon emissions and to set emission targets as appropriate. They also urged global leaders to take effective measures to keep global warming within safe levels. In 2017, Achmea Investment Management also joined PCAF. The group is part of the Dutch Sustainable Finance Platform, chaired by the Dutch Central Bank (DNB)

Over the past two years, PCAF members have worked together to define and harmonise carbon footprinting methodologies for six asset classes:

1. Government bonds
2. Listed Equity
3. Project Finance
4. Mortgages
5. Commercial Real Estate
6. Corporate Debt: Bonds and SME Loans

Based on a set of overarching accounting principles, the direct and indirect emissions (scope 1, 2 and 3 if available and relevant) of clients are attributed to the financial institution. This report presents the carbon footprinting methodologies per asset class in more detail.

Other important initiatives have emerged during this period. The Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) issued recommendations for carbon footprinting by financial institutions, in particular. PCAF believes that this report is valuable to many financial institutions that aim to implement carbon accounting in their organisation.

Any carbon accounting methodology for the financial sector can only be successful if it can rely on broad support within the sector. For this reason, PCAF remains open to further feedback following the publication of this report. PCAF invites all stakeholders to use and comment on it.

PCAF members will continue to collaborate for the next two years by sharing best practices as practitioners, addressing shared dilemmas and collaborating on improving and extending the methodologies. The group will publish an updated report on an annual basis, during two-year period, to inform stakeholders about its progress. In addition, PCAF intends to contribute to the development of a harmonised framework for science-based targets. This framework should enable financial institutions to align their portfolios better with climate scenarios.

1 Introduction

1.1 Climate Change: a call to action for the financial sector

The climate conference in Paris (COP21) produced a landmark agreement. The commitments made by 195 countries are a big leap forward. Global greenhouse gas (GHG) emissions need to be decoupled from economic growth and need to be reduced by approximately 60% by 2050 to limit global warming to well below 2 °C. Staying within a 1.5 °C temperature increase implies decisions very similar to the ones needed for a 2 °C pathway but they need to be taken (and scaled up) sooner. Climate action of all actors across sectors and countries is needed to reach the climate goals of the Paris Agreement and to transition to a low-carbon society.

The financial sector has a clear role to play in this global transition; firstly by being transparent about its footprint. It should assess and disclose where its investments – defined in their broadest sense – go and what these activities mean for Greenhouse gas (GHG) emissions. Secondly, it should describe what the financial sector can do to curtail emissions through transforming portfolios and engaging with investees. This is not just a moral appeal. Increasingly, the sector itself views climate action as being in its enlightened self-interest. Decreasing exposure to climate-related risks is increasingly seen to make good business sense.

What can the financial sector do to make this happen? Several initiatives have been launched in recent years. These initiatives range from a partnership working to understand the impact of environmental considerations on financial performance to a platform to encourage policy and investment practices to address long term risks of climate change.

UNEP Finance Initiative	2o Investing Initiative	Institutional Investors Group on Climate Change
<ul style="list-style-type: none"> Partnership between United Nations Environment Programme (UNEP FI) and the financial sector with over 200 participating financial institutions working to understand the impact of environmental considerations on financial performance Strong focus on policy, stimulating financial institutions to take part in climate negotiations Initiated the Portfolio Decarbonization Coalition: UNEP FI's platform for investor leadership on climate change with a group of financials pledging to restructure and decarbonize their portfolio and measure and disclose via the United Nations Principles for Responsible Investment (PRI) Montréal Pledge PRI Montréal Pledge: by signing, investors commit to measure and publicly disclose the carbon footprint of their investment portfolios on an annual basis 	<ul style="list-style-type: none"> Think-tank developing methodologies, metrics and policies to align investments with a 2oC scenario In 2014-2015 ran Portfolio Carbon Initiative with UNEP FI and WRI to guide financial institutions to assess the climate impact from investing and lending activities Their alignment methodologies (like sustainable energy investment metrics) enables financial institutions to align their exposure to various carbon-intensive sectors with a 2oC scenario Strong in utility sector, fossil fuel sector, automotive 	<ul style="list-style-type: none"> European platform of investors to encourage policy and investment practices to address long-term risks of climate change Encourage public policy adoption that ensure an orderly and efficient move to a low carbon economy, as well as measures for adaptation Inform investment practices to preserve and enhance long-term investment values

Figure 1. Examples of initiatives aimed to address climate change by the financial sector.

As indicated in Figure 1, some of these initiatives and legislations have resulted in a trend of carbon footprinting of investment portfolios and a rising need for transparency and uniformity of footprinting methods. Although some harmonisation attempts have been made in international initiatives, no standard has emerged yet.

1.2 Dutch developments: PCAF

Several Dutch financial institutions have worked on increased transparency related to their carbon footprint for years. Some of the Dutch frontrunners have signed PRI's Montréal Pledge, and others are members of the Portfolio Decarbonization Coalition. These organisations are committed to report their carbon footprint and set targets to reduce their climate exposure.

At the end of 2015, eleven Dutch financial institutions joined forces to improve carbon accounting through PCAF. The founding members are banks (ABN AMRO, ASN Bank, de Volksbank and Triodos Bank), asset owners (PME and PMT), asset managers (ACTIAM, APG, MN, and PGGM) and a development bank (FMO). At the COP21 in Paris, these members published the Dutch Carbon Pledge, committing to calculate their carbon emissions and to set emission targets as appropriate. They urged global leaders to take effective measures to keep global warming within safe levels. Achmea Investment Management joined PCAF in 2017. In the same year, PCAF joined the Dutch Sustainable Finance Platform, chaired by the Dutch Central Bank (DNB).¹

1.2.1 PCAF governance

PCAF is facilitated by the ASN Bank with Piet Sprengers as Chair, Freek Geurts as Secretary and Jeroen Loots as Coordinator for the project. PCAF started with four working groups, with each chaired by a different financial institution: Listed Equity (Erik Jan Stork, APG), Project Finance (Albert van Leeuwen, FMO), Government Bonds (Kees Ouboter, Actiam) and Mortgages (Laura van Heeswijk, de Volksbank). After the publication of its progress report, PCAF started two new working groups, Corporate Debt Finance (Thierry Oeljee, Achmea Investment Management) and Real Estate (Tjeerd Krumpelman, ABN AMRO). PCAF engages regularly with a Sounding Board that consists of the following organisations: ASR, Kempen & Co, ING, Rabobank, Van Lanschot, Dutch Municipal Bank (BNG) and the Dutch Banking Association (NVB).

1.2.2 The objective, mission and vision of PCAF

The objective of PCAF is to improve carbon accounting by increasing transparency and uniformity in carbon footprinting and target setting.

PCAF aims to harmonise carbon footprinting methodologies that can be applied to calculate the emissions of Scope 3 Category 15 (Investments) in the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard. It builds on GHG Protocol methodology, expanding on it where appropriate. Ideally, this methodology will also be suitable and methodologically aligned with calculating the avoided emissions of project finance (GHG Protocol for Project Accounting). PCAF's goal is to harmonise methodologies per asset category, improve the robustness of the methods used and improve data quality. It also aims to promote a single carbon emissions 'language' and reporting method.

PCAF distinguishes reporting, monitoring and steering in its approach to carbon footprinting. While striving for underlying methodologies and metrics that can serve all those purposes, it acknowledges that differentiations may be inevitable to serve all these purposes well. PCAF supports the ultimate objective that investors should, over time, move beyond monitoring their carbon footprint to one or more of the following objectives: asset (risk) management, liability (funding) management and/or broader responsibility, long term stability and impact management. In this sense, a solid carbon footprint is the requirement for credible, science-based targets that would allow financial institutions to effectively and demonstrably bring their actions in line with the Paris Agreement. This is described in more detail under section 2.1.

It is important to emphasize that it is up to financial institutions themselves to decide on methodologies for target setting, including underlying metrics. These may differ from metrics used for external reporting.

1.2.3 PCAF and the TCFD Recommendations

In June 2017 – around the time of the publication of the PCAF progress report – the TCFD published its final report with recommendations for better disclosures. There is some overlap in the work of the TCFD and PCAF. TCFD also issues recommendations for carbon footprinting by financial institutions. These are discussed in supplemental guidance for the financial sector, included in an annex "Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures" to the final report.

¹ The Sustainable Finance Platform is a cooperative venture of De Nederlandsche Bank (chair), the Dutch Banking Association, the Dutch Association of Insurers, the Federation of the Dutch Pension Funds, the Dutch Fund and Asset Management Association, the Netherlands Authority for the Financial Markets, the Ministry of Finance, the Ministry of Infrastructure and the Environment, and the Sustainable Finance Lab. The aim of this platform, set up by DNB in 2016, is to promote and encourage a dialogue on sustainable finance in the financial sector.

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The TCFD presents a number of common carbon footprinting and exposure metrics (section D.5 of the annex). One of these – carbon footprint, measured as financed emissions divided by portfolio market value – resembles the approach taken by PCAF for most asset classes. This was the preferred metric in the draft TCFD recommendations report published in December 2016. Following a public consultation, the TCFD decided to recommend a different metric for asset owners and asset managers in its final report. The preferred metric of the TCFD is a weighted average carbon intensity (WACI), i.e., emissions normalised by revenue, which differs from the metrics proposed by PCAF.

As the TCFD acknowledges, and as this report shows, carbon footprinting can be done in many different ways and for different purposes. No single metric serves every purpose best. The TCFD has taken a financial risk angle – the financial impact of climate change on financial institutions – whereas PCAF focuses mainly on impact: the impact of (the actions of) financial institutions on the climate. Arguably, a carbon intensity approach is more closely linked to financial risk, while the metrics in this report have more of a bias to an impact assessment of financial institutions.

Two other arguments support PCAF's decision not to adopt WACI. First, we believe that this metric is more difficult to understand and interpret for external stakeholders than an absolute carbon footprint normalised by assets under management (i.e. million euro invested). Second, the WACI cannot be used across asset classes, in particular mortgages. Uniformity across asset classes – to the extent possible – has been an important PCAF objective.



PCAF group photo, from left to right:

Thierry Oeljee (Achmea Investment Management), Han van der Hoorn (PGGM), Albert van Leeuwen (FMO), Jeroen Loots (ASN Bank/ de Volksbank), Kees Ouboter (Actiam), Piet Sprengers (ASN Bank/ de Volksbank), Tjeerd Krumpelman (ABN AMRO), Itske Lulof (Triodos Bank), Freek Geurts (ASN Bank/ de Volksbank), Lucian Peppelenbos (APG)

PCAF participants that do not appear in the photo: Erik Jan Stork (APG), Joost Slabbekoorn (APG), James Niven (Triodos Bank), Stefan Janssen (Triodos Bank), Colette Grosscurt (Actiam) and Nando van Kleeff (MN)

1.3 The purpose and scope of this document

PCAF's work is open source. PCAF actively welcomes external suggestions and recommendations to improve the methodology it has developed.

This document is intended to provide a clear overview of the work that has been executed by PCAF. It should provide insight into what the next steps should be and what gaps in methodology or data have emerged. The report provides an overview of carbon footprinting methodologies per asset class and is a step toward harmonised accounting methods for these asset classes.

1.4 The structure of this document

The GHG Protocol, developed by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), is the leading standard on carbon accounting. To increase the accessibility and legibility of this report, we use the layout and structure of the GHG Protocol as guidelines. To make it easy to find relevant topics for interested financial institutions, we provide the results per asset class and present the findings in easy to read tables. Finally, it is important to realise that the PCAF 'project' is work in progress. Any methodological gaps and data will be completed at a later stage.

This document contains footprinting guidance for the following asset classes: government bonds, listed equity, project finance, mortgages, commercial real estate, corporate debt and corporate SME loans. In Chapter 2, the reasons for calculating the carbon footprint of these asset classes are explored in more detail. Chapter 3 sets the principles of this type of carbon footprinting. Chapter 4 details methodologies arising from these principles per asset class. This is done in accordance with the thematic working group order of PCAF. Chapter 5 lists which aspects are critical when reporting a carbon footprint. Chapter 6 describes next steps for PCAF. Finally, a glossary of terms is provided in Chapter 7.

2 Why would a financial institution calculate the carbon footprint of its assets?

2.1 Business goals

Before exploring the methods and key assumptions in more detail, the objectives financial institutions could have for determining the carbon footprint of their assets should be assessed. PCAF identifies the following objectives for carbon footprinting:

	Risk Management and Steering	Value creation
Internal (steering purpose)	Risks management: a high carbon footprint could imply a potentially high risk in an increasingly decarbonised economy. Steering: Meaningful carbon footprint data enables institutions to understand, monitor and steer more intentionally on impact goals within and between sectors	Active ownership: at a granular level, relative carbon footprint data are indicators of (carbon) efficiency of a given organisation, sovereign or asset when compared with their peer group, or over time. Data acts as supporting material for engaging with investees on their carbon footprint.
External (reporting purpose only)	Stakeholder management: clients and beneficiaries increasingly demand that their savings are managed in a way that is resilient to climate change. They may withdraw money (if they can) and entrust their savings with another financial institution if they feel that climate risks are not managed properly.	Broader responsibility, long term stability and impact management: by reducing the carbon footprint, financial institutions reduce the likelihood and impact of climate change and contribute to a better world. Insight in the carbon footprint is a prerequisite to this type of target-setting.

These objectives may sometimes determine the choice of metrics used. For instance, if an organisation's main objective is to generate a positive impact, accuracy and completeness are important. For strategies aimed at external reporting, simplicity and comparability may dominate. A financial institution which steers on its carbon footprint may wish to keep external factors – such as asset prices – constant. An alternative approach could be that a financial institution announces intentions, and manages expectations by explaining that external factors are out of its control. Furthermore, a financial institution that wants to assess its climate-related risks can use the carbon footprint data and metrics differently, for instance related to policy regulations on emission reductions and carbon pricing per sector.

In general, PCAF members support the ultimate objective that financial institutions should exert their influence (through asset allocation and active ownership) to accelerate the transition to a low carbon economy.

3 Principles of carbon accounting for financials

3.1 GHG Protocol

The basis for carbon accounting is the GHG Protocol, as explained in chapter 1. This protocol defines three distinct different scopes that all entities may report separately, see Figure 2. In the next section, these scopes are used from the perspective of the reporting of a financial institution (FI). In the next chapter where asset classes are detailed further, these asset classes are part of the FI scope 3 category 15 (Investments) or financed emissions. In the carbon footprint methodology description per asset class, scope 1, 2 and 3 refer to the scopes from the viewpoint of the investee, being a project, company, person or a country.

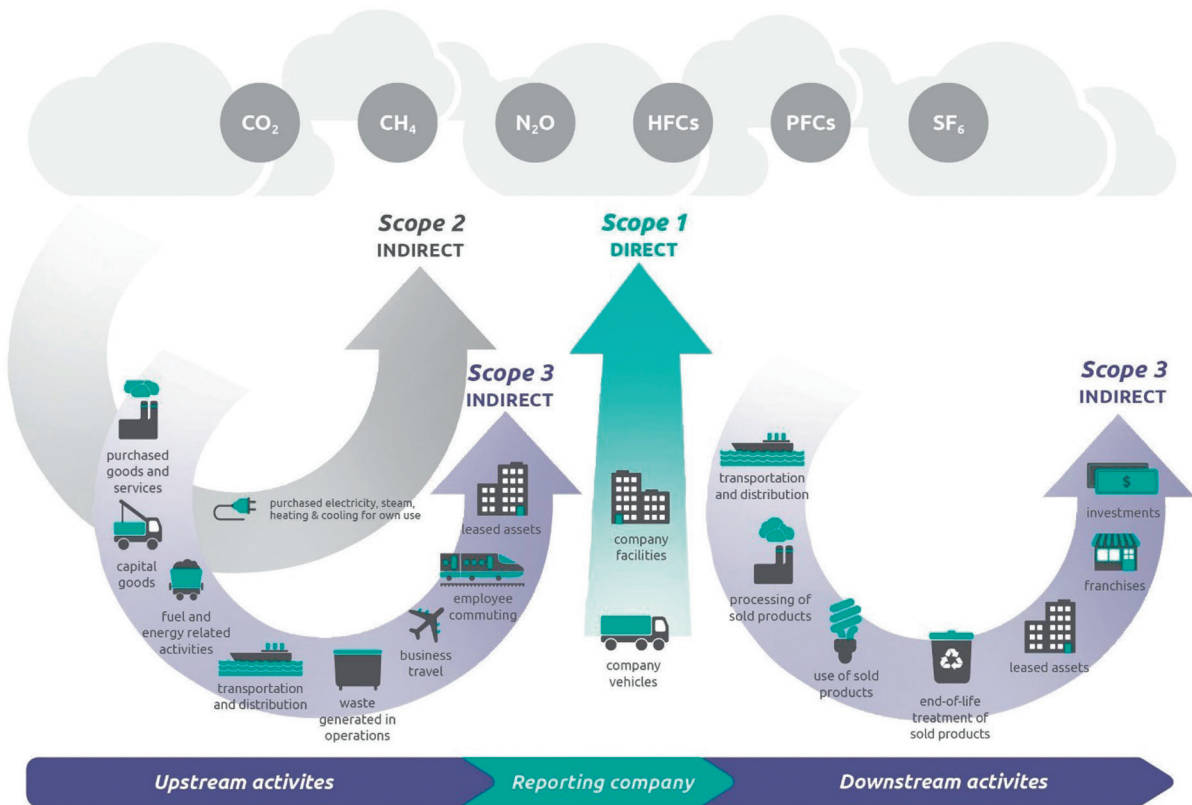


Figure 2. The scope definitions from the GHG Protocol (Image from GHG Protocol).

3.2 Overarching principles

This section lists common sets of basic design and accounting principles for carbon accounting for financial institutions, regardless of the type of investment. These principles will provide guidance on how to account for, and report, on financed emissions / avoided emissions by a financial institution. In order to distil a set of overarching principles, PCAF members rely on work already done on this topic. For an overview of work that served as inspiration, see Appendix B.

To define basic design and accounting principles, PCAF members made a practical selection from principles for carbon accounting that are already available and combined them with generally accepted accounting principles.

3.2.1 Recognition

The carbon footprint of any financial institution should, according to the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, include:

- Scope 1 of the reporting financial institution: all direct GHG emissions
- Scope 2 of the reporting financial institution: indirect emissions from the consumption of purchased electricity, heat or steam
- Scope 3 categories that are relevant or material for the reporting financial institution. Scope 3 covers other indirect emissions such as the extraction and production of purchased materials and fuels, outsourced activities, business travel, waste disposal etc.

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Scope 3 category 15 (Investment) is highly relevant for financial institutions and the focus of this report.

3.2.2 Presentation and disclosure

Financed emissions should be accounted for, and be reported, at least annually. The following disclosure requirements are proposed by PCAF:

Purpose:

- Ensure the carbon footprint appropriately reflects the GHG emissions of the financial institution and serves the decision-making needs of users – both internal and external.
- meet the specific carbon footprint goals of the financial institution; for instance, because the financial institution is working towards a specific carbon footprint target or to monitor the effectiveness of its wider strategic goals in this area.

Coverage:

- The completeness of the financial institution's carbon footprint; disclose and justify any specific exclusions.
- Coverage of asset classes; disclose if the footprint is cross-asset or only for the relevant asset classes
- Coverage of the assets that are included; disclose the percentage of the assets included in the carbon footprint per asset class, preferably all assets per asset class but at least the majority
- Past performance; disclose the carbon footprint of multiple comparable time periods (e.g. years)

Transparency:

- Assumptions; disclose any relevant assumptions and make appropriate references to the accounting methodologies and data sources used.
- Metrics; disclose the financial institution's absolute and/or relative emissions plus an explanation of their difference
- Recalculations of previous reporting years; a recalculation can be made of the financial institution's previous reports using the most recent, most relevant or most accurate data to be able to make a more reliable comparison between the current report and previous years. The recalculation steps should be made transparent.
- Reporting; provide an explanation of scope 1 (direct), 2 and 3 (indirect) in a simple and precise manner.
- Prudence; show scope 1, 2 and 3 separately to ensure comparability, avoid understating financed emissions and provide transparency on potential areas of double counting.

3.2.3 Measurement

PCAF proposes to measure the carbon footprint according to these general principles:

Gases and units:

- The seven GHGs listed in the Kyoto protocol are measured: carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). These seven gases can be expressed in Carbon Dioxide equivalents (CO₂e).
- Absolute emissions are expressed in metric tonnes of carbon dioxide equivalents: tCO₂e.
- Relative emissions are expressed in metric tonnes of carbon dioxide equivalents per million Euro invested: tCO₂e/M€.

Attribution:

- Follow the money is a key principle for footprinting of financial assets, i.e. the money should be followed as far as possible to understand and account for the carbon impact in the real economy.
- In principle scope 1, 2 and relevant categories of scope 3 of the investee should be included in the carbon footprint. When deviating from this (e.g. when scope 3 is not relevant), it should be made clear why.
- Influence of the financial institutions on steering the investment, if the influence is bigger, also the proportional share for accounting the footprint to the investment is larger.
- The denominator, i.e. the financial value of the asset that, in relation to the investment, determine the proportional share for accounting the carbon footprint, should include all financial flows (i.e. equity and debt) to the investee as much as possible. When deviating from this, it should be made clear why.

These overarching principles were applied consistently to design and agree upon the carbon footprinting methodology per asset class.

3.3 General limitations

3.3.1 Double counting

Double counting occurs when GHG emission or emission reduction is counted more than once towards attaining mitigation pledges or financial pledges for the purpose of mitigating climate change.

Apart from the double counting that intrinsically occurs between the different scopes, double counting can take place at five levels:

- Between financial institutions
- Co-financing of the same entity or activity
- Between transactions within the same financial institutions
- Across different asset classes
- Within the same asset class

PCAF recognises that double counting of GHG emissions can't be avoided completely, but it should be avoided as much as possible. Double counting between co-financing institutions and between transactions within the same asset class of a financial institution may be avoided by appropriate attribution rules.

3.3.2 Flow versus stock

When measuring GHG emissions we use a flow variable to assess how much GHGs is emitted over a specific period, typically during a year. However, when we determine the contribution of the investor to these emissions we consider an investor's portfolio at a specific point in time (stock). This can give the wrong information about what an investor actually contributed during the whole year.

For example, if an investor owns 100% of company X during the entire year, but sells all his shares on December 30th. The calculation on December 31st wouldn't show the shares of company X anymore and the influence the investor exerted on the company during the year is not expressed correctly in the carbon footprint.

A solution could be to include the number of days in the attribution factor, as in this example, a factor of 364/365. This would provide a more balanced opinion about the investors contribution, but is more data intensive and complex.

In the formulas in chapter 4, it should be noted that the subscript t (time) has different meanings for emissions (flow) and portfolio value (stock).

3.4 Avoided emissions

In this context, avoided emissions are investments in, for example, renewable energy projects or energy efficiency products leading to lower GHG emissions elsewhere in the economy. Reporting on avoided emissions is a way to quantify and demonstrate a positive contribution to preventing climate change.

For the financial sector, which provides finance for projects and products that lead to avoided emissions, quantifying this effect could be interesting as well. Avoided emissions are most relevant for project finance, where there is a direct link between the involvement of the financial institution and a reduction in GHG emissions. It is important to quantify and report avoided emissions separately from actual emissions. Otherwise financial institutions could "cherry pick"; i.e. only focusing on the positive impact of a portfolio and purposefully ignoring the negative impacts.

In calculating these avoided emissions, it is important to select the right baseline (i.e. average product or technology on the market) and to be conservative to limit the chance of overstating avoided emissions. This baseline represents emissions that would have occurred if the project had not been implemented. The difference between emissions from the baseline and emissions from the project are avoided emissions.

3.5 Principles for emissions data

An important element of carbon footprinting is the availability of high quality data on emissions of investments. Different asset classes present unique challenges and opportunities with respect to emissions data. This section gives a few overarching principles on the quality and desired hierarchy of emissions data, with more detailed guidance provided on specific asset classes in chapter 4.

High quality of emissions data is defined as follows:

- Emissions data is consistent, both across entities and across time;
- Emissions data reflects the underlying emissions generating activities of the entity, and are not impacted by unrelated factors;
- Emissions data is accompanied by some form of assurance.

It is unlikely that emissions data meet all the criteria listed above, and that this is dependent on the specific properties of the investment, such as: type of investment, the sector or market best practice. Therefore, broadly speaking, the following hierarchy of preference is proposed:

1. Emissions data as disclosed by the entity itself accompanied by some form of assurance on the disclosed data by a credible independent institution. This source is the preferred source for emissions data as it captures the specific characteristics of the investment (e.g. technology, geography, activities) in the best way. Assurance provided (e.g. through additional disclosure on methodology, certifications or external audit/validation) gives the financial institution additional comfort that the data offers a fair representation of its underlying emissions generation activities.
2. Emissions data calculated on the basis of verifiable non-GHG source data, using credible calculation tools. This is preferred if the entity does not disclose emissions data directly, but is able to provide or disclose non-GHG source data. From this data (e.g. mining/industry/power production, fuel use), the emissions data can be estimated, and the resulting estimate should give a reasonable approximation of emissions generated on the basis of the underlying activity.
3. Emissions data as disclosed by the entity itself without assurance, and/or emission estimates obtained from environmental input/output models or intensity-based models. The advantage of these estimation models is that they require relatively limited input data and can therefore be used in the absence of detailed data on the specific investment.

4 Carbon footprinting methodology per asset class

This chapter covers the methodologies as detailed by the six working groups of PCAF. All methodologies follow from the overarching principles outlined in the previous chapter. The asset classes covered are:

1. **Government bonds**
2. **Listed Equity**
3. **Project Finance**
4. **Mortgages**
5. **Commercial Real Estate**
6. **Corporate Debt: Bonds and SME Loans**

All paragraphs below use the same form of table for clarity and to enable a direct comparison between asset classes. When parts of a table remain empty, it shows no decision has been made on this aspect yet or the item is not relevant for this asset class. Each asset class also lists a case study meant as a best practice. These practices have merits and limitations, and alternative approaches are possible.

	Outcome
Scopes covered	Decision on minimum requirements.
Portfolio coverage	Decision on minimum requirements.
Attribution	How is the investor's share of the total emissions of the investee attributed?
Data	What data to use? What data considerations are important for this decision?
Absolute vs. relative emissions	What type of emission metric needs to be presented and how should the reporting institution arrive at this?
Avoided emissions	A description of how to account for avoided emissions when applicable.
Asset class specific considerations	Room for additional, asset class-specific considerations.
Limitations	The limitations of the proposed methodology are discussed.

4.1 Government bonds

This section covers government bonds or ‘sovereign bonds’. PCAF considers a government bond to be a debt security issued by a central government to support government spending. As such, the emissions caused by a government bond not only lead to emissions caused by the central government’s own operations, but predominantly by how the government finances other sectors within the country.

Topic	Outcome
Scopes covered	According to the follow the money principle, scopes 1, 2 and scope 3 purchased goods and services of the government are covered. No clear guidance exists on minimum requirements yet. Calculate and report the different scopes separately. For steering and risk mapping purposes it is useful to see what steps of the governmental spending are most exposed to carbon emissions. For reporting purposes, the separation of scopes is necessary to allow separate government decision makers to draw informed conclusions.
Portfolio coverage	All government bonds should be covered.
Attribution	Attribution is proportional to the exposure of the financial institutions (i.e. the sum invested in a government bond) in relation to the government debt+equity. As government equity is often not disclosed and a financial institution can’t invest in government equity, PCAF proposed to use only government debt as denominator.
Data	Eurostat provides up to date and credible input-output and emission tables, which have been used to calculate the carbon footprint of European government bonds. However, for many non-European bonds, it is more difficult to find reliable and accurate data sources. Ideally, the calculation would be based on uniform global input-output tables coupled with emission sources for the economic sectors per country. Based on the principles for emissions data, only data from input/output models can be derived so far.
Absolute vs. relative emissions	$(1) \quad absolute\ footprint_t = \sum_{asset \in portfolio} \frac{exposure_t}{denominator_t} emissions_{t-delay}$ $(2) \quad relative\ footprint_t = \frac{absolute\ footprint_t}{AuM_t}$ <p>In equation (1), the variable emissions refer to the emissions of a portfolio asset in period t. In this case these are the emissions of government bonds, hence of governments (scope 1, 2 and 3). The exposure is the amount of euros invested in a specific government bond. The denominator (government debt) can be seen as the value that defines which part of CO₂e emissions can be attributed to the portfolio or as the value that normalises the CO₂e emissions. Countries can be compared by their normalised CO₂e which cancels out the size bias of a country. The delay mentioned arises from a typical delay in emissions reporting. Under ideal circumstances, this should be zero.</p>
Avoided emissions	Green Bonds issued by a government could lead to avoided emissions. How this should be accounted for depends on the type of ring-fenced asset classes.

4.1.1 Asset class specific considerations

Comparability with listed equity in mixed funds	The decision on the denominator is, like the decision on scope, dependent on the purpose of carbon accounting. Because there is an advantage in comparing the GHG emissions of government bonds with the GHG emissions of other classes, the choice of denominator is important. For steering on carbon in mixed funds that include sovereigns and other assets or bonds, PCAF members want to keep the denominators of different asset classes as similar as possible. In an ideal scenario the government debt + equity would be use as denominator, describing the government balance. PCAF members urge governments to be more transparent about their data as governmental equity is often not disclosed.
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State owned companies	State-owned companies are not included in this analysis. Their emissions could be attributed to scope 3 of government but it is not certain if state-owned companies are already taken into account in the money flows of economic input-output tables. There is also no publicly available database with state-owned enterprises per country. Including state-owned enterprises is recommended, but requires governments to disclose this information.
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Energy imports and exports in I/O tables	Input-output tables do not account for energy imports and exports.
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4.1.2 Limitations

Government debt as denominator	Central government debt is chosen as denominator as this is the entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date. Moreover, the information on government debt is readily available in databases for practically all governments. However, the absolute level of a country's debt influences the indicator and makes comparison between countries difficult. If government debt is low, a large proportion of emissions is allocated to a government bond. A bond may therefore have high emissions despite the fact that the government itself has an emphasis on energy efficiency and renewable energy and may have effectively realised energy efficiency measures. The reverse is also true: this metric implies a positive bias to high-debt governments. If government equity is also taken into account in the denominator, we expect the problem would be less prevalent. However, data on government equity is not readily available.
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4.1.3 Calculation example

Description of example	In this example we show the carbon footprint calculation for investments in the Dutch government bond. Input-output tables are linked to GHG emission accounts to determine the share of the governmental spending in the GHG emissions per sector. Central government debt is used as denominator.
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Used data	<ul style="list-style-type: none"> Central Government Debt, 2015, derived from Eurostat table: <i>Government deficit/surplus, debt and associated data [gov_10dd_edpt1]</i> Share of government spending per NACE activity, 2014, derived from Eurostat table: <i>Symmetric input-output table at basic prices (industry by industry) [naio_10_cp1750]</i> GHG emission account per NACE activity, 2014, derived from Eurostat table: <i>GHG/Air emissions accounts by industry and households (NACE Rev. 2) [env_ac_ainah_r2]</i>
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Calculation and results	The central government of the Netherlands has a debt of €409,8 billion in 2015. The direct emissions of the Dutch government are extracted directly from Eurostat by summing the emissions of economic activity (NACE) category O (Public administration and defense; compulsory social security).
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The following table shows the direct emissions of the Dutch government:

Direct emissions by the Dutch government	
Carbon dioxide (tCO ₂)	1,637,881
Methane (tCO ₂ e)	182,727
Nitrous oxide (tCO ₂ e)	28,358
Hydrofluorocarbons (tCO ₂ e)	-
Perfluorocarbons (tCO ₂ e)	-
Sulphur hexafluoride (tCO ₂ e)	-
Total direct emissions in tCO₂e	1,848,966

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The indirect emissions, scope 2 and 3, are calculated by following government expenses within sectors and determining the financed emissions within each sector. The financed emissions in NACE category D (electricity, gas, steam and air conditioning supply), comprise Scope 2 emissions of the central government. By summing all financed emissions in the other NACE sectors, we can calculate the scope 3 emissions of the Dutch central governmental spending, see the table below.

NACE code	NACE activity	Financed by the Dutch government (million euro)	Total financing in the sector (million euro)	Share of government financing per sector	GHG emissions per sector (tCO ₂ e)	Financed emissions by the government (tCO ₂ e)
A01	Crop and animal production, hunting and ...	153	23,757	0.6%	29,041,641	187,034
A02	Forestry and logging	9	116	7.8%	67,404	5,230
A03	Fishing and aquaculture	3	179	1.7%	504,620	8,457
B	Mining and quarrying	186	39,610	0.5%	3,055,640	14,349
U	Activities of extraterritorial organisations	-	-	0.0%	-	-
Total indirect emissions in tCO ₂ e						6,721,466

By summing the direct and indirect emissions and dividing this by the central government debt, the relative emissions for the Dutch government bond are calculated, as shown in the table below. The absolute carbon footprint for the financial institution can be derived by multiplying the relative emissions with the financed amount.

	GHG Emissions (tCO ₂ e)	Government debt (Million euro)	Emission factor (tCO ₂ e/M€)
Scope 1 emissions	1,848,966		4.51
Scope 2 emissions	1,555,326		3.79
Scope 3 emissions	5,166,140		12.60
Total emissions	8,570,432	409,883	20.91

4.2 Listed equity

Topic	Outcome
Scopes covered	Scope 1 and scope 2 minimum. Scope 3 if available and relevant. Report scope 1, 2 and 3 separately. The reason to measure these scopes separately, even though this will require greater effort, is that scope 1 eliminates double counting and measures direct impact, also of a potential carbon tax. The reason to not include scope 3 as a mandatory requirement is that this would require better accounting and disclosure. To date, the comparability, coverage, transparency and reliability of scope 3 data is insufficient.
Portfolio coverage	Ideally, 100% of the portfolio should be covered. At least the majority of the portfolio should be covered and an indication should be provided for a pathway to full coverage. Provide an explanation of which product type (futures, ETFs, fund of funds, external mandates, prefs) were included or excluded and what the main method was for estimating missing data. Cash positions can be considered as having zero emissions. Short positions can be ignored.
Attribution	PCAF proposes that emissions are proportionally attributed to the providers of the company's total capital. In order to prevent double counting from this perspective, emissions are attributed proportionally to the exposure divided by the sum of enterprise value (total debt and equity). In case a financial institution only invests in equity and undertakes carbon footprinting from a risks perspective, emissions can also be attributed to the total market capitalisation (market value of all of a company's outstanding shares) of this company. This follows the so-called ownership approach and is aligned with financial reporting and consolidation rules. It also aligns voting rights and rules for reporting substantial interest in listed companies.
Data	Due to the potentially large universe of listed equity portfolios, the data source will likely be a designated data vendor. PCAF does not recommend a preferred data vendor. Analysis of Kepler Cheuvreux for IIGCC demonstrates that for scope 1 and 2 emissions differences between data vendors are 12-24%. It is encouraged to use the most recent available data and to mention the data source, reporting period or 'time stamp' of these data. Data vendors collect emissions data as reported by listed companies themselves, either through a standardised framework such as CDP or through a company's own disclosures in official filings and (environmental) reports. Disclosure through CDP has the advantage that the disclosed data are accompanied by additional information on the scope and methodology used. PCAF has a preference for data reported by companies, given that the data fully covers the emissions generating activities of the company. Not all companies disclose data on their emissions. Reporting in emerging markets lags behind developed markets. To maximise the coverage of emissions data, the remaining gaps are often filled with estimates. Preferably, estimation models used are consistent and reflect the underlying emissions generating activities of the entity. Production-based models are preferred over revenue-based models from a consistency point of view as they are less sensitive to exchange rate or commodity price fluctuations. Production-based models are especially useful for carbon intensive industries like utilities, materials, energy and industrials. Revenue-based models (e.g. intensity-based or environmental input-output models) have the advantage of requiring less detailed data.
Absolute vs. relative emissions	As a minimum, PCAF suggests to disclose both absolute and relative emissions. For relative emissions, we propose to divide the absolute carbon footprint with the total assets under management.
Avoided emissions	Avoided emissions are not appropriate for this asset class

4.2.1 Asset class specific considerations

Aggregation of output	A financial institution may choose an appropriate level of aggregation of outputs; for instance, should the overall portfolio footprint be reported, or is aggregation at more homogenous sub-levels more relevant, for instance advanced and emerging markets?
Challenges in steering carbon footprint	In addition, PCAF will further investigate the challenges linked to steering a carbon footprint and describe the metrics currently in use by investors as emerging practice ² .

4.2.2 Limitations

Market price fluctuations	When using market value as denominator it is important to realise that assets under management change as a result of a fluctuating market price. An objective to reduce a relative footprint by a certain percentage becomes a moving target under the influence of this fluctuation. ³
Company identifiers	For larger portfolios, it is important to have unique company identifiers in order to combine information from various sources. Examples of such identifiers are: SEDOLs, ISINs, CUSIPs, Bloomberg Tickers. For large portfolios, matching external data sources can be a challenge when for example two companies merge; the company identifiers will be adjusted immediately while carbon data providers might only update such information on an annual basis.

4.2.3 Calculation example

Description of example The absolute footprint of an investment in a company is calculated by multiplying the total emissions by the proportional share in the company. The absolute footprint of a portfolio of companies is calculated as the sum over all footprints over time period t.

$$(1) \quad absolute\ footprint_t = \sum_{company \in portfolio} \frac{invested\ value_t}{enterprise\ value_t} emissions_t$$

$$(2) \quad relative\ footprint_t = \frac{absolute\ footprint_t}{AuM_t}$$

When using market capitalisation as denominator instead of enterprise value the absolute footprint is calculated as follows:

$$(1.2) \quad absolute\ footprint_t = \sum_{company \in portfolio} \frac{invested\ value_t}{market\ cap_t} emissions_t$$

² TABP/APG use normalised invested value. This is a metric that corrects for market fluctuations but does account for capital allocations. The metric is calculated as the number of participation that a client has in the fund multiplied by the price of a participation in a reference year. It represents the invested value at this year's market price levels. The advantage of the metric is that achieving the target becomes independent of market volatility. Disadvantage is that the normal economic growth is also neutralised which makes the target more ambitious in case of economic growth.

³ A possibility to overcome this would be to use normalised assets under management, whereby prices are held constant over the target period. Such adjustments should be made transparent.

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Used data

The information required for these calculations is:

Emissions: can be taken from company reports if available but for large portfolios external data providers are often used. Examples of data sources include: CDP, Bloomberg, MSCI, Trucost and Southpole. In the choice of data source, asset managers will have to compare the various options (for example on coverage, data quality, transparency, service, costs, etc.).

Market capitalisation, Total Borrowings, Customer Deposits: this information is widely available in commercial market intelligence tools and commercial providers of financial data that are used by investors.

Invested value: this information is normally available in the internal systems used by investors for portfolio management and performance monitoring.

Calculation and results

Fund I is composed of two listed companies and contains a bit of cash (5 million).

Company	Market cap	Total Borrowings	Customer Deposits	Enterprise value	Invested	Total emissions
A	37.5 billion	14.5 billion	0	52 billion	100 million in a-shares and 50 million in b-shares	500 ton CO ₂ e
B	18 billion	4 billion	0	22 billion	90 million	400 ton CO ₂ e
Cash					5 million	
Total invested					245 million	

Using Enterprise Value as denominator:

Total emissions company * (invested value / (market cap + total borrowings + customer deposits))

For company B: $400 * (90\text{mln} / (18\text{bln}+4\text{bln}+0\text{bln})) = 400 * 0.41\% = 1.64 \text{ ton CO}_2\text{e}$

For company A: $500 * (150\text{mln} / (37.5\text{bln}+14.5\text{bln}+0\text{bln})) = 500 * 0.29\% = 1.44 \text{ ton CO}_2\text{e}$

For cash no emissions are attributed

Total absolute carbon footprint = $1.64+1.44 = 3.08 \text{ ton CO}_2\text{e}$

The relative carbon footprint is calculated by dividing the absolute carbon footprint over the invested value (per million).

Total relative carbon footprint = absolute footprint / invested value per million invested

Total relative carbon footprint = $3.08 \text{ ton CO}_2\text{e} / 240 = 12.8 \text{ kg CO}_2\text{e per million invested}$

Using only market cap as denominator:

Total emissions company * (invested value / market cap)

For company B: $400 * (90\text{mln} / 18\text{bln}) = 400 * 0.5\% = 2 \text{ ton CO}_2\text{e}$

For company A: $500 * (150\text{mln} / 37.5\text{bln}) = 500 * 0.4\% = 2 \text{ ton CO}_2\text{e}$

For cash no emissions are attributed

Total absolute carbon footprint = $2+2 = 4 \text{ ton CO}_2\text{e}$

The relative carbon footprint is calculated by dividing the absolute carbon footprint over the invested value (per million).

Total relative carbon footprint = absolute footprint / invested value per million invested

Total relative carbon footprint = $4 \text{ ton CO}_2\text{e} / 240 = 16.7 \text{ kg CO}_2\text{e per million invested}$

4.3 Project finance

Topic	Outcome
Scopes covered	Scope 1 and scope 2 minimum. Scope 3 if relevant.
Portfolio coverage	Ideally, 100% of the project portfolio should be covered. The coverage of the project portfolio should be clearly indicated. The coverage of security types should also be stated clearly.
Attribution	<p>Ratio of the investment (either debt, equity and/or mezzanine) over total project size (total debt+equity necessary to realise the project).</p> <p>Guarantees have no attribution, until they are called and turned into loan.</p> <p>PCAF proposes to use actual outstanding exposure. For debt, this means adjusting the numerator annually (for instance reflecting the end-of-year exposure), resulting in the attribution to decline to 0 at the end of the lifetime of the loan (when it is fully repaid).</p> <p>The denominator consists of the total debt + equity. The total debt is the total outstanding exposure in the year of reporting (either at year-end or as the average outstanding investment over the reporting year). The total equity remains constant regardless of value fluctuations, until the moment the FI would buy or sell shares, or the investee would issue additional shares (diluting investor exposure) or would buy back shares (increasing investor exposure).</p>
Data	<p>Within the due diligence and monitoring of a project finance transaction, the availability of project-specific data is generally good. As a result, higher quality GHG data can be obtained than would be available through generic input/output models, without adding an unrealistic amount of additional work to the process. Therefore, it is proposed that GHG data for project finance should not be based on generic input-output models, but on project-specific source data.</p> <p>Project finance is being applied to a broad range of sectors, activities, project sizes and geographies, and there is not one broadly accepted and universally applicable set of source data and calculations available. One can however distinguish a hierarchy of preference, providing guidance in selecting the highest quality level within the limitations of availability.</p> <p>Project-specific independently validated GHG data ranks highest in quality and consistency, but will not always be available. The next best level of data quality and consistency that can be obtained in a practical way, is to calculate the GHG emissions from relevant non-GHG source data provided by the client (like the consumption of electricity, of fuels and of certain sector-specific raw materials), using credible standardised calculation tools. Only if neither of these options work, it is acceptable to use non-validated GHG data provided by the client or to use data from sector average input/output models.</p> <p>Therefore, the following hierarchy of preference is proposed:</p> <ol style="list-style-type: none"> 1. Project-specific GHG data, validated by independent expert in accordance with the GHG Protocol and/or UNFCCC or another credible certification scheme. 2. GHG data calculated from verifiable non-GHG source data, using pre-approved calculation tools (such as the IFC-CEET or the AFD carbon tool for industry or power production, FAO EX-ACT tool for agriculture). 3. Client provided GHG data, not validated by independent expert in accordance with the GHG Protocol and/or UNFCCC or another credible certification scheme, or sector average input/output model based GHG data.

When estimating the expected carbon footprint of a project already at the time the investment is made (when the project is not yet operational), it is essential that the methodology provides guidance on the way the annual production is estimated (conservative/neutral/aggressive scenario). For renewable energy projects, it is customary to have experts calculate percentile production predictions based on an analysis of historic data resource data (wind, irradiation, hydraulic flow etc.). The P50 value is the predicted annual production for which there is a 50% probability that it will be exceeded in a given year. The P90 value is the predicted value that has a probability of 90% of being exceeded in a given year (the 1 year P90), or of being exceeded in an average year over a 10 year period (the 10 year P90). PCAF proposes to use the P50 predicted production.

Absolute vs. relative emissions Please note that in this context, relative emissions are not the emissions per unit of production, but per monetary unit of finance. Standard approach should be reporting absolute as well as relative emissions. PCAF states that the methodology depends on the goal, e.g. monitoring and communication purposes or steering portfolios against a carbon target.

Avoided emissions PCAF proposes to adopt a more sophisticated methodology than using the average grid emission factor to account for avoided emissions. Such a methodology is currently being developed by a harmonisation initiative of international finance institutions in collaboration with the UNFCCC. In the meantime, PCAF proposes the following hierarchy of preferred sources for the baseline emission factors:

1. UNFCCC validated reports (CDM or otherwise)
2. Emission factors and calculation methodology from the IFI Approaches to GHG Accounting for Renewable Energy Projects and for Energy Efficiency Projects
3. For projects involving forestry, biomass or (other) carbon sequestration: dedicated carbon balance studies performed by independent experts.

4.3.1 Asset class specific considerations

Lifecycle emissions Lifecycle emissions, such as manufacturing, transporting and installing equipment should be accounted for to incentivise more efficient production in the future. When this is not possible, this should be clearly stated. PCAF will investigate accounting for the emissions from the construction and decommissioning of projects for renewable energy projects. PCAF foresees using an agreed estimation model. These emissions could be neglected when they are below a 5%; a de minimis threshold often used by the GHG Protocol.

Accounting timeframe The most commonly adopted accounting principle for GHG emission and other ESG data is to account for and report on the actual emissions that have taken place in the portfolio during the most recently completed reporting period (usually a calendar year). This approach is also proposed for project finance. However, project finance inherently relates to an activity that will only start after development, construction and commissioning have been completed, which is often years later, and may even be after the institution having provided the project finance is no longer exposed because it has been sold or otherwise refinanced. In order to be able to account for the impacts of investment decisions in the year that these investments are being made, several (development) finance institutions calculate and report on estimated future ('ex-ante') annual GHG emissions for all new investments in a given year. PCAF proposes that the methodology provides for both ex-ante (estimated) and ex-post (actual) emissions.

Boundary setting The boundaries (both for the GHG emission calculation and for the attribution) are set around the project; if the project is not fully greenfield (i.e. a newly build project) this means that only the financed extensions are included and the emissions and financials related to the existing activities and/or installations are not considered.

4.3.2 Limitations

Emissions data	Although in project finance the availability of relevant project-specific data is high relative to some of the other asset classes, expert GHG emission reports, specific to the project will often not be available. Instead, the emissions data will be based on project-specific source data, being calculated into emissions data using sector- and country-specific factors.
Lifecycle emissions	As mentioned before, it is proposed to neglect lifecycle emissions if these are smaller than 5% of total lifetime (avoided) emissions. If bigger than 5% these emissions should be accounted for, but in most case this must be based on generic model-based data. PCAF proposes to account and report for the emissions related to e.g. construction only in the years in which they occur, so only during the construction period. In case the lifecycle emissions may not be neglected, it's not agreed yet how to attribute them over the reporting years.

4.3.3 Calculation example

Description of example	Project: Greenfield windfarm project in Costa Rica, comprising of 25 2MW wind turbines Start of construction: February 2012 Start of operation: November 2013 Installed capacity: 50 MW Total investment: 150 mln USD
Used data	<p>Estimated annual electricity production Source: wind studies and turbine supplier data, verified and confirmed by the Lenders Technical Advisor. Alternatives: use P90 (lenders' base case) or P50 (equity base case). As over the lifetime of the wind park the average annual production should equal the P50 value, it is proposed to use P50</p> <p>Data: P90: 200 GWh/yr P50: 230 GWh/yr</p> <p>Actual production Source: audited data provided by the company</p> <p>Data: 2012: 0 GWh/yr (not yet in production) 2013: 50 GWh/yr (production started in Q3) 2014: 220 GWh/yr 2015: 240 GWh/yr ... 2023: 230 GWh/yr 2024: 220 GWh/yr</p> <p>Funding Source: finance documentation Data: 50 mln USD equity + 100 mln USD debt (from 4 lenders)</p> <p>Transaction Source: own systems Data: 12yr loan of 20 mln USD, approved in 2011, signed in 2012.</p> <p>Outstanding debt (only principal, at end of year): Source: own systems Data:</p>

year	own outstanding debt [mln. USD]	total outstanding debt [mln. USD]
2011	0	0
2012	20 (15 disbursed)	100 (75 disbursed)
2013	20	100
2014	20	100
2015	18	95
....		
2023	2	10
2024	0	0

Project ('gross') GHG emissions

Emissions from construction, transport and production of the windfarm (predominantly scope 3) are mostly neglected over the lifetime of the project, but it could be approximated at 629 tCO₂e per MW installed.

Source: AFD carbon calculation tool.

Data: construction GHG emission: 31,450 tCO₂e

Emissions from operation (may contain both scope 1 and 3) are commonly neglected, but it could be considered to approximate this.

Source: fuel + electricity consumption data from company & AFD tool.

Data: operational GHG emission: < 500 tCO₂e/yr

Reference scenario GHG emissions

To be able to calculate avoided emissions it is necessary to estimate the baseline emission factor that would apply if the electricity had to be produced in the absence of the project in a most likely alternative scenario. The most authoritative framework on calculating can be found in the UNFCCC approved methodologies. For CDM registered projects a validated baseline emission factor is available. For non-registered projects, it is most common to use the average grid emission factor (mostly from the IEA). As this does not take the merit order for electricity dispatch into account, nor the aspect of electricity consumption growth, this results in a bias, notably in countries with high penetration of renewable energy and in countries with suppressed demand. Therefore, an alternative calculation method for grid emission factors is currently being developed by IFI's in collaboration with UNFCCC.

Source1 (CDM registered project): UNFCCC

Data1: 355.9 tCO₂e/GWh

Source2 (non CDM registered, simple average grid factor): IEA

Data2: 81 tCO₂e/GWh

Source3 (non CDM registered, corrected grid factor): IFI Harmonisation Framework

Data3: 239 tCO₂e/GWh (used in this example)

Calculation and results

Attribution

attribution factor = outstanding debt and/or equity / total outstanding debt + total equity

2011: 0%

2012: 20 / 150 = 13.33%

2013: 13.33%

2014: 13.33%

2015: 18 / 145 = 12.4%

....

2023: 2 / 60 = 3.33%

2024: 0%

Absolute gross emission from construction and operations, non-attributed
ex-ante estimate (reported ultimo 2012): 500 tCO₂e/yr

2011: 0
2012: 50% of construction emission = 15,700 tCO₂e/yr
2013: 50% of construction emission = 15,700 tCO₂e/yr
2014-end: < 500 tCO₂/yr

Absolute gross emission from construction and operations, attributed
ex-ante estimate (reported ultimo 2012): 13.33% x 500 = 67 tCO₂e/yr

2011: 0
2012: 13.33% x 15,700 = 2,100 tCO₂e/yr
2013: 13.33% x 15,700 = 2,100 tCO₂e/yr
2014: 13.33% x <500 = <67 tCO₂e/yr
2015: 12.4% x <500 = <62 tCO₂e/yr

.....
2023: 3.33% x <500 = <17 tCO₂e/yr
2024: 0

Relative gross emission from construction and operation:

ex-ante estimate: <500,000/150,000,000 = <0.003 kg CO₂e/yr / USD

2011: 0
2012: 15,700,000/150,000,000 = 0.105 kg CO₂e/yr / USD
2013: 15,700,000/150,000,000 = 0.105 kg CO₂e/yr / USD
2014-end: <500,000/150,000,000 = <0.003 kg CO₂e/yr / USD

Absolute avoided emission, non-attributed

ex-ante estimate: 500 - 230 x 239 = - 54,500 tCO₂e/yr

2011: 0
2012: 15,700 tCO₂e/yr
2013: 15,700 - 50 x 239 = 3,750 tCO₂e/yr
2014: 500 - 220 x 239 = - 52,100 tCO₂e/yr
2015: 500 - 240 x 239 = - 56,900 tCO₂e/yr

...
2023: 500 - 230 x 239 = - 54,500 tCO₂e/yr
2024: 500 - 220 x 239 = - 52,100 tCO₂e/yr

Absolute avoided emission, attributed

ex-ante estimate: 13.3% x - 54,500 = 7,300 tCO₂e/yr

2011: 0
2012: 13.33% x 15,700 = 2,100 tCO₂e/yr
2013: 13.33% x 3,750 = 500 tCO₂e/yr
2014: 13.33% x - 52,100 = - 7,000 tCO₂e/yr (avoided emissions)
2015: 12,4% x - 56,900 = - 7,100 tCO₂e/yr

...
2023: 3.33% x - 54,500 = - 1,800 tCO₂e/yr
2024: 0 x - 52,100 = 0 tCO₂e/yr

Relative avoided emission:

ex-ante estimate: - 54,500,000/150,000,000 = - 0.363 kg CO₂e/yr / USD

2011: 0
2012: 15,700,000/150,000,000 = 0.105 kg CO₂e/yr / USD
2013: 3,750,000/150,000,000 = 0.025 kg CO₂e/yr / USD
2014: - 52,100,000/150,000,000 = - 0.347 kg CO₂e/yr / USD
2015: - 56,900,000/150,000,000 = - 0.379 kg CO₂e/yr / USD

...
2023: - 54,500,000/150,000,000 = - 0.363 kg CO₂e/yr / USD
2024: 52,100,000/150,000,000 = - 0.347 kg CO₂e/yr / USD

4.4 Mortgages

Topic	Outcome
Scopes covered	Energy use of financed buildings (scope 1 and 2).
Portfolio coverage	100% of the on-balance mortgages.
Attribution	100% of building, even if a lower share is covered by the mortgage. PCAF proposes since the financial institution is often the only provider of a mortgage, and is therefore in the position to exert influence. Mortgages are one of the few asset classes where a financial institution can directly engage with its customers and take responsibility for a societal challenge. The energetic characteristics of the financed properties are taken into account in investment decisions regardless of the size of the mortgages. Also, PCAF is not in favour of using loan-to-value (LTV) ratio as this leads to emissions fluctuating with property value.
Data	<p>The data availability on energy consumption of properties has improved considerably due to policy regulations on built environment (like buildings codes and energy labels). The available data are usually averaged over a number of households in the same peer group to anonymise the data. Various sources are available, dividing energy consumption by for instance energy label, type of household/sector and type of property. When applying these data on a large number of financed properties it is possible to get a reasonable approximation of the CO₂e-emissions.</p> <p>Based on the data available, the following data hierarchy is proposed:</p> <ol style="list-style-type: none"> 1. Actual energy consumption from a grid operator, converted to CO₂e-emissions using verified emission factors specific to the type of energy consumed. 2. Actual energy consumption from a grid operator, converted to CO₂e-emissions using grid emission factors for energy from undefined fuel source. 3. Average energy consumption per postal code regions, converted to CO₂e-emissions using grid emission factors for energy from undefined fuel source. 4. Average energy consumption sector and/or energy label specific, converted to CO₂e-emissions using general grid emission factors. <p>PCAF suggests to work with actual data on the energy consumption of the properties, if available. For the Netherlands, PCAF is in contact with the national association of grid operators, Netbeheer Nederland, to provide actual energy consumption data.</p>
Grid emission factors	<p>The consumed gas and electricity on household level can be converted to CO₂e-emissions using grid emission factors. Within the Netherlands, www.co2emissiefactoren.nl gives a list of widely accepted and uniform grid emission factors.</p> <p>PCAF has chosen to use the grid emission factor related to direct emissions, expressed under column TTW-value on www.co2emissiefactoren.nl. Whenever the origin of the consumed electricity is unknown, the emission factor for electricity from undefined energy source should be used. The factor for electricity is updated regularly to reflect changes in the Dutch electricity mix.</p> <p>For 2017 measurements this leads to the following emission factors: 0.301 kg CO₂/kWh for electricity, and 1.788 kg CO₂/m³ for natural gas.</p>
Absolute vs. relative emissions	The methodology results in absolute emissions per household/building. This information can be further specified and translated into relative emissions based on preferred disclosure on the portfolio.
Avoided emissions	A mortgage on a house that is climate-positive, i.e. generating more energy than it consumes, could be seen as avoided emissions. However, this is not covered yet in this report.

4.4.1 Asset class specific considerations

Obtaining data on energy consumption	Actual consumption data, made anonymous, but specific for a certain mortgage portfolio is preferred. The actual energy consumption will be more accurate than working with the average energy consumption per energy label.
Off-balance mortgages and subsidiaries	The scope of this methodology is on on-balance mortgages, therefore off-balance are not included. If relevant, additional metrics can be included to disclose on off-balance mortgages.
Distinguishing between private and corporate mortgage	No distinction is made between private or corporate mortgages.

4.4.2 Limitations

Result dependent of data quality	Many assumptions must be made in order to calculate the emissions of mortgages as data are often difficult to retrieve due to privacy reasons. Even though the calculation method does not differ greatly, the data sources used can yield different results, for instance when average consumption data are replaced by actual consumption data coming from grid operators. Furthermore, if actual consumption data are used, it is not clear if all the energy consumption is applicable solely for the house or for instance also for an electric car. The actual energy consumption data can be further refined using the type of electricity used.
Country specific assumptions	Some country specific adjustments need to be made to make the calculation applicable for a certain country. The Dutch energy label, for instance, is the result of a European directive and differs from ways to categorise energy efficiency of houses in other EU countries and countries outside of Europe. Country specific adjustments need to be considered depending on the data availability and standards in each country.
Double counting	As 100% of the emissions per mortgage is attributed to the mortgage provider, it is possible that in some cases houses with mortgages at multiple providers get double counted.

4.4.3 Calculation example

Description of example	The emissions for a fictional house in a mortgage portfolio, and the emissions for a fictional mortgage portfolio.
Used data	<ul style="list-style-type: none"> Emission factors for electricity of undefined fuel source and natural gas are derived from the Dutch CO₂-database available at www.co2emissiefactoren.nl Energy labels are provided by the Netherlands Enterprise Agency (RVO). The average natural gas and electricity consumption for Dutch households per energy label are derived from 'Energimodule WoON 2012'.⁴
Calculation and results	<p>Example calculation for a fictional house</p> <p>A mortgage of €100,000 is provided for a house with a value of €350,000. The Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland - RVO) provides a list of definitive and provisional energy labels for all households in the Netherlands. This particular house has an energy label G.</p> <p>Databases on consumption data, like the one provided by WoON2012, reveal the average consumption of gas and electricity for Dutch households per energy label. The annual average consumption for gas and electricity for energy label G is 1,883 m³ and 2,942 kWh respectively according to this source.</p>

⁴ In the meantime we are constantly looking for a better single data source that is publicly available and accessible for FIs.

The gas and electricity consumption are then expressed in CO₂e emissions using direct emission factors for electricity from undefined energy source in the Netherlands and direct emission factor for natural gas; 0.301 kg CO₂/kWh, and 1.788 kg CO₂/m³ for natural gas.

$$CO_2\text{emissions} = (\text{gas consumption} \times EF_{\text{gas}}) + (\text{electricity consumption} \times EF_{\text{electricity}})$$

$$CO_2\text{emissions}_{\text{Energylabel G}} = (1,883 \times 1.788) + (2,942 \times 0.301)$$

$$CO_2\text{emissions}_{\text{Energylabel G}} = 3,367 + 886$$

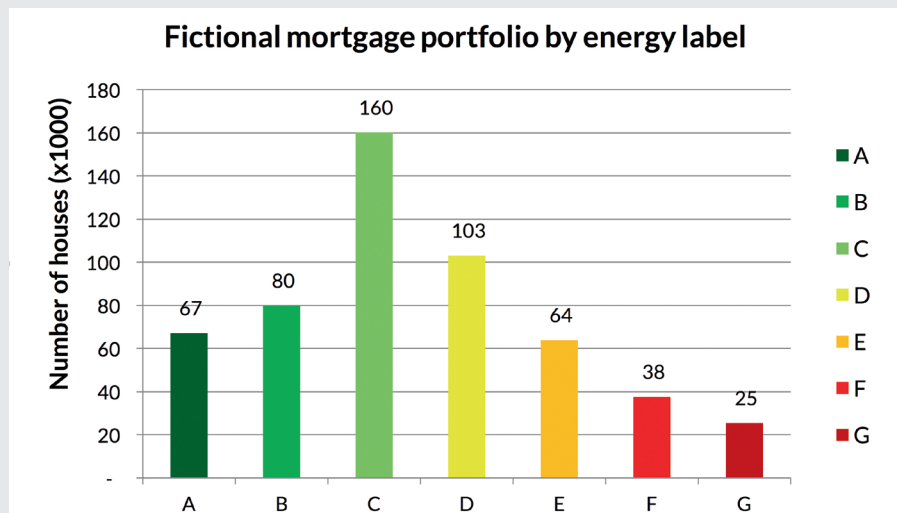
$$CO_2\text{emissions}_{\text{Energylabel G}} = 4,253 \text{ kg CO}_2\text{e}$$

The complete emissions of 4.3 tCO₂e are allocated to the mortgage provider for this particular €100,000 mortgage as long as the mortgage is not repaid.

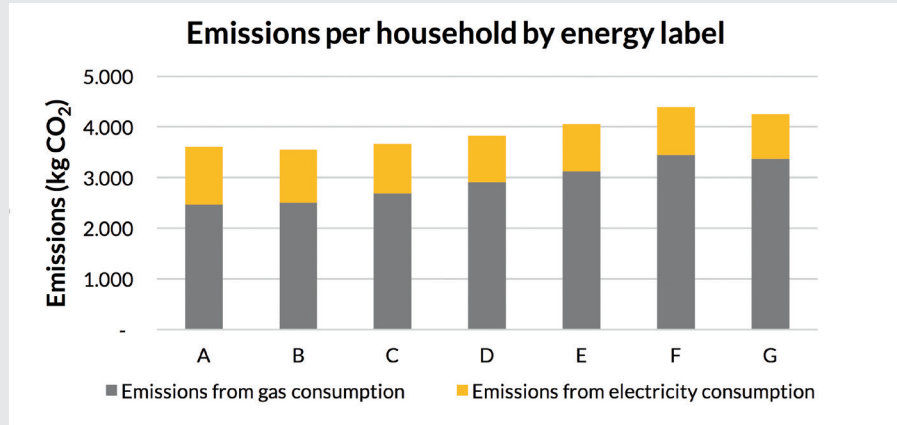
If actual energy consumption data are available, then these data are preferred over the calculation using average consumption data.

Example calculation for a fictional Dutch mortgage portfolio

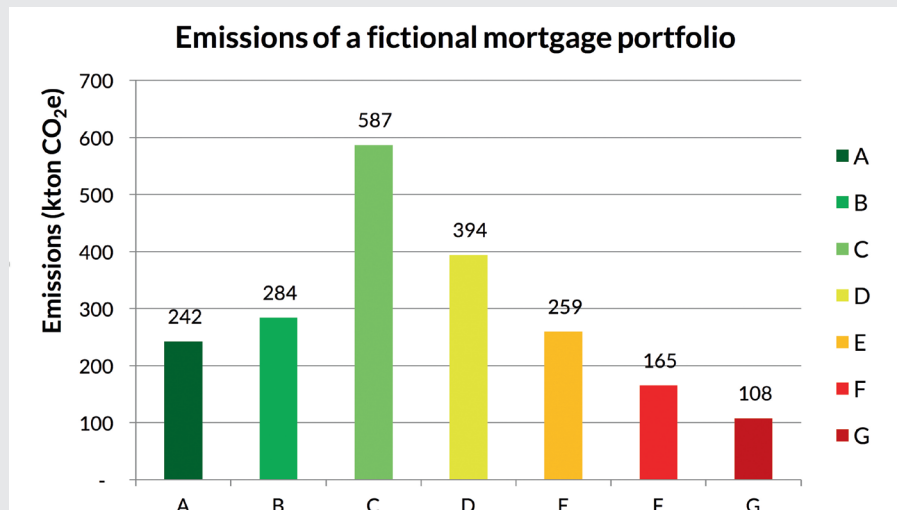
The calculation can be taken to portfolio level if we apply the same method to a whole portfolio. We assume a mortgage portfolio of 107 billion euro, consisting of 537 thousand houses, we can categorise the houses in the portfolio by energy label as shown in figure below.



The CO₂e emissions for each energy label are calculated by following the same calculation steps as previously shown for energy label G. This leads to the following figure.



The emissions per energy label are then multiplied by the number of houses per energy label. By summing the emissions of the houses in each energy label category, the total CO₂e emissions for the fictional mortgage portfolio are 2,039 kton CO₂e.



4.5 Commercial Real Estate

Topic	Outcome
Scopes covered	Energy use of financed buildings (scope 1 and 2).
Portfolio coverage	100% of the on-balance finance (loans, mortgage..) to commercial real estate.
Attribution	Proportional in relation to the total project costs in case of newly developed building or property value (i.e. market value) for existing buildings at time of investment
Data	<p>The data availability on energy consumption of properties has improved considerably due to policy regulations on the built environment (like buildings codes and energy labels). The available data are usually averaged over a number of properties in the same street/region to anonymise the data. Various sources and commercial databases are available, dividing energy consumption by for instance energy label, type of property, floor area of property. When applying these data on a large number of financed properties it is possible to get a reasonable approximation of the CO₂e-emissions.</p> <p>The consumed energy can be converted to CO₂e-emissions using conversion factors, ideally specified according to the type of energy consumed.</p> <p>Based on the data available, the following data hierarchy is proposed:</p> <ol style="list-style-type: none"> 1. Actual energy consumption from a property, converted to CO₂e-emissions using verified emission factors specific to the type of energy consumed. 2. Actual energy consumption from a property or grid operator, converted to CO₂e-emissions using grid emission factors for energy from undefined energy source. 3. Average energy consumption building type per country/region and/or energy label specific, converted to CO₂e-emissions using general grid emission factors. <p>PCAF suggests to work with actual data on the energy consumption of the properties, if available.</p>
Grid emission factors	<p>The consumed gas and electricity on household level can be converted to CO₂e-emissions using grid emission factors. Within the Netherlands, www.co2emissiefactoren.nl gives a list of widely accepted and uniform grid emission factors.</p> <p>PCAF has chosen to use the grid emission factor related to direct emissions, expressed under column TTW-value on www.co2emissiefactoren.nl. Whenever the origin of the consumed electricity is unknown, the emission factor for electricity from undefined energy source should be used. The factor for electricity is updated regularly to reflect changes in the Dutch electricity mix.</p> <p>For 2017 measurements this leads to the following emission factors: 0.301 kg CO₂/kWh for electricity, and 1.788 kg CO₂/m³ for natural gas.</p>
Absolute vs. relative emissions	The methodology results in absolute emissions for the commercial real estate in the portfolio. This information can be further specified and translated into relative emissions based on preferred disclosure on the portfolio.
Avoided emissions	Real estate finance that is climate-positive, i.e. a property generating more energy than it consumes, could be seen as avoided emissions. However, this is not covered yet in this report.

4.5.1 Asset class specific considerations

Obtaining data on energy consumption	Actual energy consumption data of the commercial real estate in the portfolio is preferred, as the actual energy consumption will be more accurate than working with the average energy consumption per energy label.
Off-balance real estate finance and subsidiaries	The scope of this methodology is on-balance real estate finance, therefore off-balance real estate finance is not included. If relevant, additional metrics can be included to disclose on off-balance real estate.

Distinguishing between private and corporate commercial real estate	No distinction is made between private or corporate commercial real estate.
----------------------------------------------------------------------------	-----------------------------------------------------------------------------

4.5.2 Limitations

Country specific assumptions	Some country specific adjustments need to be made to make the calculation applicable for a certain country. The Dutch energy label, for instance, is the result of a European directive and differs from ways to categorise energy efficiency of houses in other EU countries and countries outside of Europe. Country specific adjustments need to be considered depending on the data availability and standards in each country.
Property value	When using property value (i.e. market value) for attributing the emissions of an existing commercial building, this value could change over time due to market developments. This will affect the attributed share of emissions to the investments. PCAF proposes to apply the property value at time of investing.

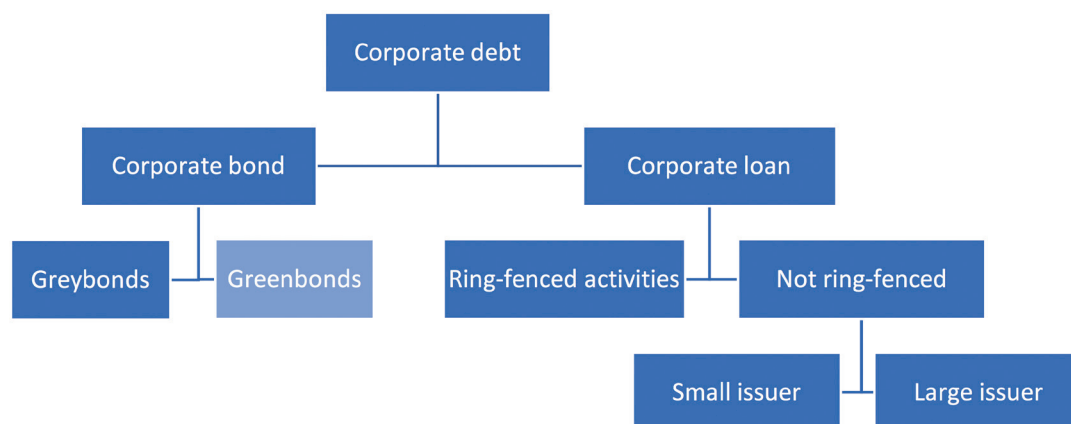
4.5.3 Calculation example

Description of example	The emissions of a real estate investment for a fictional school in a real estate portfolio.
Used data	<ul style="list-style-type: none"> Emission factors for electricity of undefined energy source and natural gas are derived from the Dutch CO₂-database available at www.co2emissiefactoren.nl The energy intensity per building type and sector are derived from 'Ontwikkeling energiekentallen utiliteitsgebouwen (2016)'.
Calculation and results	<p>Example calculation for a fictional real estate property</p> <p>A loan of €5,000,000 is provided for a high school with a floor space of 6,000 m² and total property value of €20,000,000, at time of investing. According to 'Ontwikkeling energiekentallen utiliteitsgebouwen (2016)' the gas intensity is 13 m³/m² floor area, and an electricity intensity of 37 kWh/m².</p> <p>The gas consumption is estimated on:</p> $\begin{aligned} \text{gas consumption} &= \text{floor surface} \times \text{gas intensity}_{\text{sector}} \\ \text{gas consumption} &= 6,000 \times 13 \\ \text{gas consumption} &= 78,000 \text{ m}^3 \end{aligned}$ <p>The electricity consumption is estimated on:</p> $\begin{aligned} \text{electricity consumption} &= \text{floor surface} \times \text{electricity intensity}_{\text{sector}} \\ \text{electricity consumption} &= 6,000 \times 37 \\ \text{electricity consumption} &= 222,000 \text{ kWh} \end{aligned}$ <p>The gas and electricity consumption are then expressed in CO₂e emissions using direct emission factors for electricity from undefined energy source in the Netherlands and direct emission factor for natural gas; 0.301 kg CO₂/kWh, and 1.788 kg CO₂/m³ for natural gas.</p> $\begin{aligned} \text{CO}_2 \text{emissions} &= (\text{gas consumption} \times \text{EF}_{\text{gas}}) + (\text{electricity consumption} \times \text{EF}_{\text{electricity}}) \\ \text{CO}_2 \text{emissions}_{\text{high school}} &= (78,000 \times 1.788) + (222,000 \times 0.301) \\ \text{CO}_2 \text{emissions}_{\text{high school}} &= (139,464) + (66,822) \\ \text{CO}_2 \text{emissions}_{\text{high school}} &= 206,286 \text{ kg CO}_2 \text{e} \end{aligned}$ <p>Attributing these emissions to the loan provided result in the carbon footprint for this investment:</p> $\text{Attributed CO}_2 \text{emissions}_{\text{high school}} = \frac{5,000,000}{20,000,000} \times 206,286 \text{ kg CO}_2 \text{e} = 51,571 \text{ kg CO}_2 \text{e}$

4.6 Corporate debt

This section covers credits investments as discussed and concluded by PCAF. Given the variety of debt instruments available we distinguish between various categories that each requires its own approach.

The corporate debt working group considers the following categories⁵ to be in scope of its work:



Topic	Outcome
Scopes covered	Scope 1 and scope 2 data as a minimum. Including Scope 3 if available and relevant. Report scope 1, 2 and 3 separately. The reason to measure these scopes separately, even though this will require greater effort, is that scope 1 eliminates double counting and measures direct impact, also of a potential carbon tax. The reason to not include scope 3 as a mandatory requirement is that this would require better accounting and disclosure. To date, the comparability, coverage, transparency and reliability of scope 3 data is generally insufficient.
Portfolio coverage	Ideally, 100% of the portfolio should be covered. At least the majority of the portfolio should be covered and an indication should be provided for a pathway to full coverage. Provide an explanation of which product types were included or excluded and what the main method was for estimating missing data. Cash positions can be considered as having zero emissions. Short positions can be ignored.
Attribution	Emissions are proportionally attributed to the providers of the company's total capital. In order to prevent double counting from this perspective, emissions are attributed proportionally to the exposure divided by the sum of total debt and equity (enterprise value). In instances where the equity share is unavailable, PCAF encourages the use of an estimate or, if impossible, to ignore the equity share and divide by debt only. If alternatives are applied, this requires further clarification of the steps taken.
Data	PCAF does not recommend a specific source. Analysis of Kepler Cheuvreux ⁶ for IIGCC demonstrates that for scope 1 and 2 emissions differences between data vendors are 12-24%. It is encouraged to use the most recent available data and to mention the data source, reporting period or 'time stamp' of these data.
Absolute vs. relative emissions	As a minimum, PCAF suggests to disclose both absolute and relative emissions. For relative emissions, we propose to divide the absolute footprint with the total assets under management.
Avoided emissions	Avoided emissions are not appropriate for this asset class

⁵ For the corporate bond method we assume the bond is a grey bond. We see the carbon accounting method for Greenbonds closely aligned with the ring-fenced activities of the corporate loans section and that of avoided emissions in the project finance section. Therefore we left it out of scope for the section on corporate bonds.

⁶ Kepler Cheuvreux , 2015: Carbon Compass: Investor guide to carbon footprinting. <http://www.iigcc.org/publications/publication/investor-guide-to-carbon-footprinting>

4.6.1 Asset class specific considerations

Aggregation of output	A decision needs to be made on the aggregation of outputs; should the total portfolio be enough or should a division be made between for instance advanced and emerging markets?
Challenges	<p>Given the strong similarities between the calculation methods recommended for listed equities, please refer to the challenges listed in the listed equities paragraph. One additional general comment is that one should be aware of the potentially undesired side-effect related to attributing the issuer's absolute carbon footprint to its total equity and debt position.</p> <p>Whilst a lower carbon footprint would typically be achieved by (encouraging) issuers to reduce their absolute carbon emissions (numerator), the recommended calculation methods implies that a similar effect could be achieved by increasing the denominator, either the issuer's equity or debt position.</p>

4.6.2 Limitations

Market price fluctuations	When using the enterprise value as denominator, it is important to realise that assets under management change as a result of a fluctuating market price. An objective to reduce a relative footprint by a certain percentage becomes a moving target under the influence of this fluctuation. ⁷
Company identifiers	For larger portfolios it is important to have unique company identifiers in order to combine information from various sources. Examples of such identifiers are: SEDOLs, ISINs, CUSIPs, Bloomberg Tickers. For large portfolios match external data sources can be a challenge, when for example two companies merge in market intelligence tools the company identifiers will be adjusted immediately while carbon data providers might only update such information on an annual basis.

4.6.3 Calculation example

Description of example	<p>The absolute footprint of an investment in a company is calculated by multiplying the total emissions by the proportional share of the enterprise value of a company. The absolute footprint of a portfolio of companies is calculated as the sum over all footprints.</p> <p>(1) $absolute\ footprint_t = \sum_{company \in portfolio} \frac{invested\ value_t}{enterprise\ Value_t} emissions_t$</p> <p>(2) $relative\ footprint_t = \frac{absolute\ footprint_t}{AuM_t}$</p>
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Used data	<p>The information required for these calculations are:</p> <p>Emissions: emissions can be taken from company reports if available but for large portfolios external data providers are often used. Examples of data sources include: CDP, Bloomberg, MSCI, Trucost and Southpole. In the choice of data source asset managers will have to compare the various options (for example on coverage, data quality, transparency, service, costs etc.).</p> <p>Enterprise value: this information is widely available in commercial market intelligence tools and commercial providers of financial data that are used by investors.</p> <p>Invested value: this information is normally available in the internal systems used by investors for portfolio management and performance monitoring.</p>
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⁷ A possibility to overcome this would be to use normalised assets under management, whereby prices are held constant over the target period. Such adjustments should be made transparent.

Paving the way towards a harmonised Carbon Accounting Approach for the Financial Sector

Calculation and results

Fund I is composed of two listed companies and contains a bit of cash (2.5million).

Company	Enterprise value	Invested	Total emissions
A	62.5 billion	77.5 million in bonds with maturity (3yrs)	700 ton CO ₂ e
B	12 billion	90 million in bonds with maturity (9yrs)	250 ton CO ₂ e
Cash		2.5 million	
Total invested		170 million	

Total emissions company * (invested value / enterprise value)

For company B: $250 * (90\text{mln} / 12\text{bln}) = 250 * 0.75\% = 1.9 \text{ ton CO}_2\text{e}$

For company A: $700 * (77.5\text{mln} / 62.5\text{bln}) = 700 * 0.12\% = 0.8 \text{ ton CO}_2\text{e}$

For cash no emissions are attributed

Total absolute carbon footprint = $1.9 + 0.8 = 2.7 \text{ ton CO}_2\text{e}$

The relative carbon footprint is calculated by dividing the absolute carbon footprint over the invested value (per million).

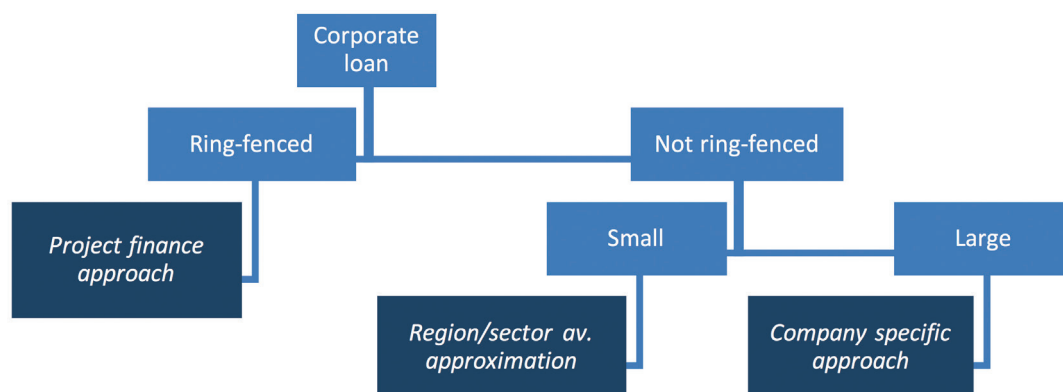
Total relative carbon footprint = absolute footprint / invested value per million invested

Total relative carbon footprint = $2.7 \text{ ton CO}_2\text{e} / 167.5 \text{ million} = 15.9 \text{ ton CO}_2\text{e per billion invested}$

4.7 Corporate/SME loans

This section covers corporate/SME loans. For the purpose of this protocol, corporate/SME loans are limited to the loans that are on the balance sheet of the financing institution.

For corporate/SME loans different accounting approaches may be followed, depending on the characteristics of the loan. This differentiation is visualised below, and is further explained in the table.



Topic	Outcome
Scopes covered	Scope 1 and scope 2 minimum. Scope 3 if relevant and available.
Portfolio coverage	As stipulated in the introduction, off-balance credit products do not need to be covered. Ideally, 100% of the portfolio should be covered. For practical reasons, credit facilities linked to current accounts may be exempted, as the credit exposure is relatively small, highly volatile and not structural. Revolving credit facilities may also be excluded, unless they are significant or material (i.e. if they account for more than 10% of outstanding credit). The coverage of the corporate/SME loan portfolio should be clearly communicated (both the criteria and the relative coverage of the outstanding exposure).
Attribution	<p>As a basic attribution principle, the lender accounts for a portion of the GHG emission of the financed company determined by the ratio between the lender's exposure and the enterprise value of the company (debt+equity): the attribution factor. For this, the actual outstanding exposure is used. This means adjusting the numerator of the attribution factor annually (for instance reflecting the end-of-year exposure), resulting in the attribution to decline to 0 at the end of the lifetime of the loan (when it is fully repaid). Institutions are free to use either year-end exposure or average exposure throughout the year, as long as the approach is communicated clearly and used consistently.</p> <p>As is further explained in the Data section, two GHG emission approaches are applied, one relying on region/sector average data, and one on actual source data provided by the borrower. While the basic attribution principle should apply to both, the practical way to arrive at the correct attribution differs.</p> <p>Approach 1: region/sector average based calculation</p> <p>When using the region/sector average data method the attribution is done by multiplying the loan exposure with the average GHG emission intensity for the applicable region/sector, i.e. GHG emissions per million euro on the financial balance (debt+equity). It is important to ensure that the GHG intensity is calculated using an estimate for the sector size that reflects the principles of enterprise value, to avoid an attribution bias between the two approaches.</p>

Approach 2: emission calculation based on source data provided by the borrower

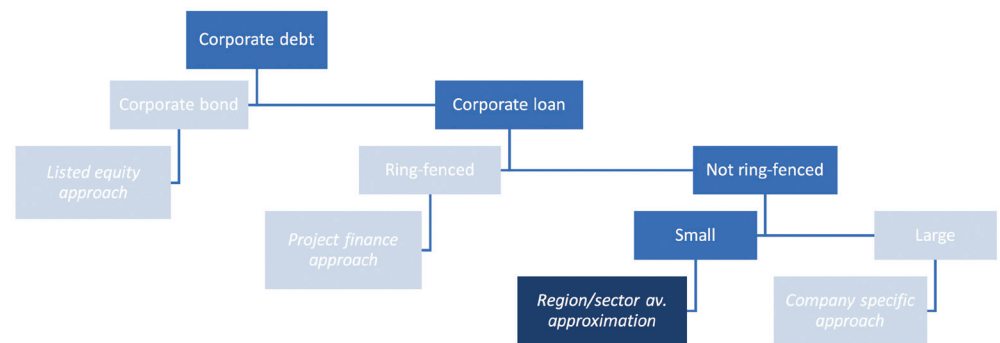
For loans that are designated for a clearly ring-fenced activity, use the protocol for project finance, even if these loans are not structured as project finance (see section 4.3). In this case, the attribution factor should be calculated by dividing the exposure of the lender by the total investment needed for the ring-fenced activity (all debt+equity). It is important to make sure that the boundaries used to ring-fence the total investment amount of this activity are same as the boundaries used to ring-fence the GHG emissions of this activity.

In other cases the attribution factor is calculated by dividing the exposure of the lender by the enterprise value of the company. Similar as above, the boundaries used to delineate the enterprise value should be similar as the boundaries used to delineate the GHG emissions.

Data

For corporate/SME loans a twofold approach is taken to estimate and account for emissions and carbon intensity. The first approach is based on region/sector specific average emissions data, using public data sources or data from third party data providers for market and emissions data. The second approach builds on company-specific source data, provided by the borrower. When reporting aggregated GHG data, it should be made clear which percentage of the reported emissions data is based on approach 1 and 2 and which criteria have been applied to decide on which approach to use when.

Approach 1: region/sector average based emission calculation



The region/sector average approach is used when the borrower does not report on GHG emissions and the transaction does not involve detailed due diligence and monitoring. This is typically the case with small exposures and/or smaller (SME) companies.

Financial institutions are allowed to determine the threshold in loan-type/size and company type/size themselves, but it should be used consistently and communicated clearly with emissions data and it should not be set higher than a maximum prescribed under this carbon accounting approach. PCAF proposes to start by setting the maximum for this threshold at 5 million euro initial exposure, and reconsider this threshold when evaluating the carbon accounting approach at a later stage.

The region/sector average approach may also be acceptable for small and/or short term (like bridge finance), non-ring-fenced credit facilities to larger companies, as these types of credit will usually not involve a detailed due diligence analysis process.

This approach is not preferred for high-emission industry sectors (such as extractive industries, heavy industries and large-scale thermal power generation). It should only be used if all the other criteria for using this approach are met and if the total exposure to such sectors is below a certain percentage of the total corporate/SME debt exposure. In other cases, the GHG emissions data from exposure to these high impact sectors should be calculated using approach 2. The PCAF proposes to apply approach 2 to high-emission industry if the exposure to these sectors exceeds 20% of the total portfolio. PCAF will reconsider this threshold when evaluating the protocol at a later stage.

The financing institution may also choose not to apply approach 1, if it is specifically financing best-in class players, or specifically financing GHG-related improvements, as obviously such impacts would not become visible using region/sector averages.

Following region/sector average approach, the emissions for each loan are calculated with the help of region/sector-based emissions data⁸, using ISIC, NACE or another internationally accepted sector classification. The region/sector based database provides the average GHG emission intensity of the financed activity. Multiplying this with the exposure amount provides an estimate for the financed emission. Sampling tests based on actual data on company level which is extrapolated to portfolio level can help to test the accuracy of calculations based on region/sector averages. This may also be used to refine the average data for specific sectors or regions, if the institution has a strong presence in and specific knowledge of this sector and/or region.

Approach 2: emission calculation based on source data provided by the borrower

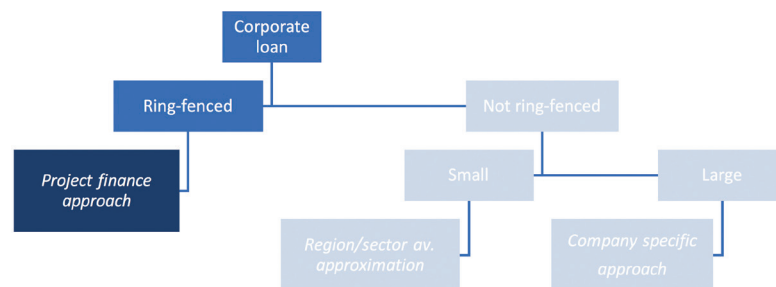
Approach 2 makes use of company-specific data provided by the borrower. This can either be GHG emissions data, or other source data from which GHG emissions data can be calculated, using an appropriate calculation methodology/tool, issued or approved by a credible independent institution.

Approach 2 is preferred from a data quality perspective, but not always realistic or practical. It is most suited for larger loans to bigger companies, as these are usually involve in a detailed diligence and monitoring and/or target companies that have good GHG emissions data available. If this is the case and the emissions of the activity to be financed are significant, company-specific data, provided by the borrower should be used, rather than region/sector averages.

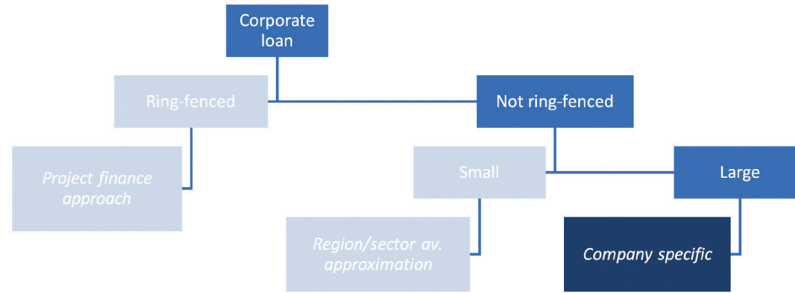
As explained in the previous section, approach 2 should also be applied for exposure to high-emission industry sectors (such as extractive industries, heavy industries and large-scale thermal power generation), regardless if the other criteria are being triggered, if the total exposure to such sectors exceeds the minimum percentage of the portfolio (see earlier remark).

The financial institution may also choose approach 2 if it is specifically financing best-in class players, or specifically financing GHG-related improvements.

For loans that are designated for a clearly ring-fenced activity, the protocol for project finance should be used (see section 4.3 of the interim report), even if they may not be structured as project finance.



⁸ It is proposed to use credible (public) data sources such as EuroStat, CBS and the International Energy Agency, or input/output models data (list may be provided at a later stage)



In other cases, PCAF proposes to follow carbon accounting approach 2 for corporate/SME loans, applying the following hierarchy of preference for the data sources:

1. Audited GHG data from the company, in accordance with the GHG Protocol;
2. GHG data calculated by a credible external expert, in accordance with the GHG Protocol or comparable credible principles;
3. Sector-specific non-GHG source data, used to calculate GHG emissions with an approved GHG calculation tool such as IFC-CEET, the AFD carbon calculation tool, or comparable sector-specific tools issued by credible institutions such as the FAO (for agriculture).

Absolute vs. relative emissions

Standard approach should be reporting absolute as well as relative emissions. PCAF states that the methodology depends on the goal, e.g. monitoring and communication purposes or steering portfolios against a carbon target.

4.7.1 Asset class specific considerations

Considerations that are specifically relevant to certain aspects of categories of debt instruments are discussed in the respective sections. For carbon footprints related to loans that are designated to finance specifically ring-fenced activities are calculated based on the approach recommended for project finance as described in the paragraph on project finance of this report. There is a small difference regarding the type of emissions that are associated with ring-fenced corporate loans. Project finance is mostly associated with avoided emissions. For ring-fenced corporate loans however, these emissions can also be emitted during the lifetime of the activity.

4.7.2 Limitations

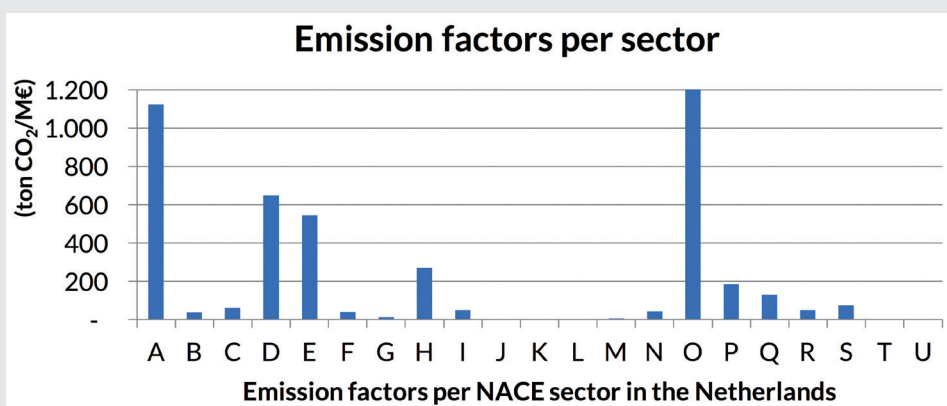
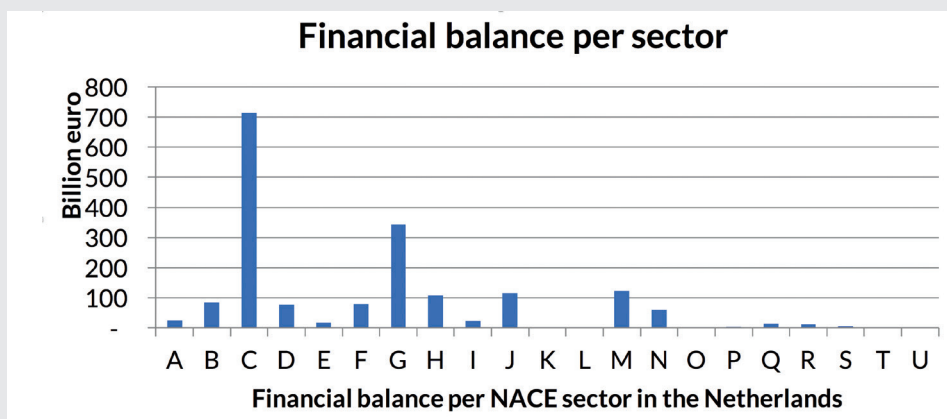
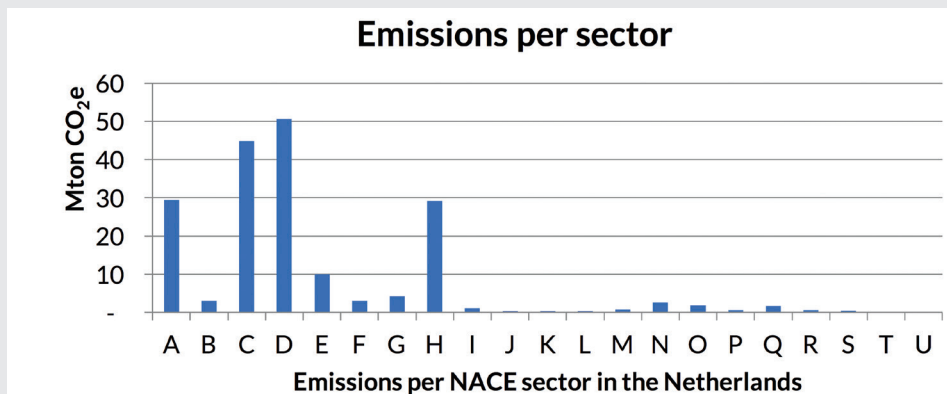
A limitation of the calculation method recommended for smaller corporate/SME loans exposures that are not ring-fenced is that it largely depends on assumptions and approximations that are derived from region and sector averages. This makes calculations based on this approach generally less robust and more uncertain than those that are based on company data. It is however a necessary evil to address the large number of smaller loans that are often given out this way.

4.7.3 Calculation example

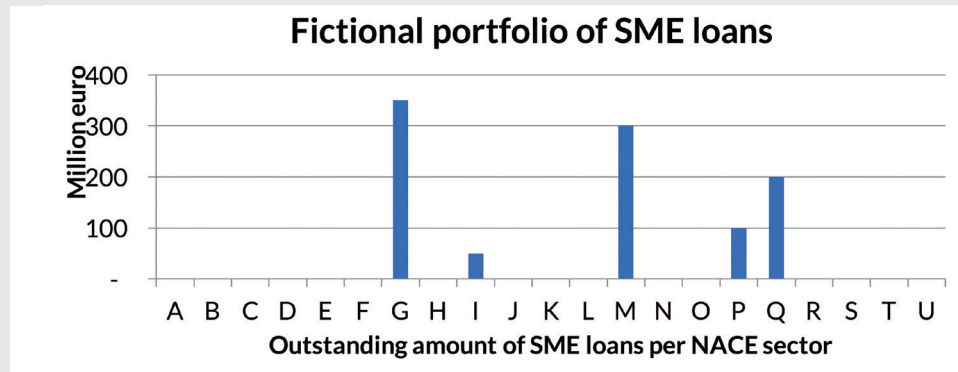
Description of example The example gives a calculation of approach 1: region/sector average based emission calculation for SME loans.

- Used data**
- Emissions per NACE sector derived from CBS: “Emissies naar lucht door de Nederlandse economie; nationale rekeningen”.
 - Financial balance per NACE sector derived from CBS; “Financiën alle ondernemingen; niet-financiële sector, SBI 2008”.

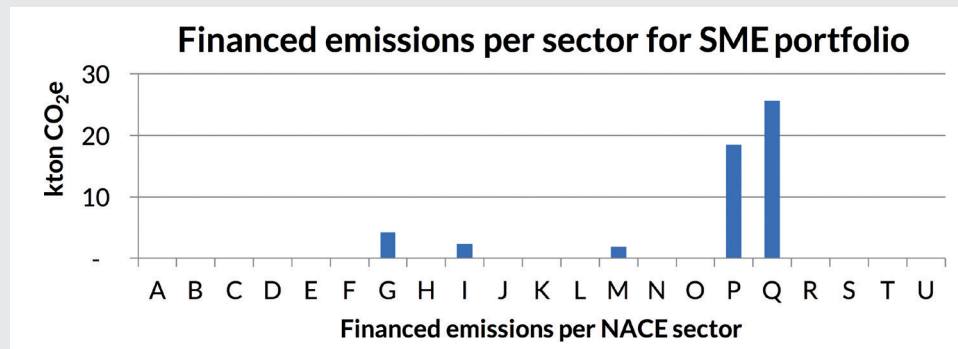
Calculation and results The sector approach involves sector averages on emissions per euro invested (based on NACE sectors). By dividing the emissions per sector by the total financial balance of the sector. This leads to emission factors, expressed in tons CO₂ per million euro.



Suppose a financial institution has a SME portfolio with 1 billion worth of loans. Only businesses active in NACE sectors G, I, M, P and Q were eligible for a loan. The 1 billion euro is divided as follows:



The CO₂-emissions from the SME portfolio is then calculated by multiplying the sum of the outstanding loans with the emission factors. This leads to the following allocated emissions to the SME portfolio. Summed up the SME portfolio of 1 billion euro leads to 52,7 kton CO₂-emissions.



5 Reporting

This chapter summarizes PCAF's reporting considerations. These considerations are grounded in the overarching principles as defined in section 3.2. This summarising section focuses on reporting and includes common approaches for all asset classes.

- Report on an annual basis. Financial institutions should at least report annually.
- Include scope 1 and 2 of investees as a minimum, scope 3 where available and relevant. PCAF considers that reporting these scopes separately is useful. Scope 3 emissions of investees should be reported clearly separated from scope 1 and 2 emissions.
- Present clearly which asset classes are included and excluded from the footprint and be transparent about the considerations. For instance, explain how certain assets were excluded based on their limited overall impact.
- Report transparently and credible. Ensure your reporting standards allow scrutiny and annual updating. Clearly describe the assumptions made to calculate the footprint.
- Explain methodology employed and limitations thereof. Describe the reasons for choosing a certain methodology and propose steps to reduce these limitations over time.
- Report absolute and relative emission footprints. Allow a direct comparison to footprint reduction KPI's.
- Explain changes in footprint from one year to the next. Have these changes occurred due to actions from the reporting institution or did they arise from actions outside of their control?

6 Next steps

PCAF has become an effective, collaborative initiative and intends to build on this positive start in the future. The conclusion of the first phase of the group's work – delivering a report which details a new, open source methodology for financial institutions to account for their carbon footprint – is, in many ways, only the start.

The group of carbon accounting front-runners have also committed to work together for another two years as practitioners sharing best practices, addressing shared dilemmas and collaborating on improvements to the methodology. The group will publish an updated report on an annual basis, for this two-year period, to keep stakeholders informed about its progress. Below an overview of the activities PCAF will perform over the coming two years. When and how this is done is at the discretion of the members, recognising the urgent need to transition to a low carbon economy.

6.1 Stakeholder consultation

Following a progress report in April 2017, PCAF solicited feedback from a wide range of external stakeholders like experts, governments, companies, NGOs.

This feedback has been integrated in this final document. PCAF also wants to align its carbon accounting guidance with other initiatives. Any carbon accounting methodology for the financial sector can only be successful if it can rely on broad support within the sector. For this reason, we remain open to further feedback following the publication of this document.

6.2 Implementing carbon accounting and sharing best practices

By implementing carbon accounting with each organisation, the group will address questions such as:

- data quality, including questions of how to evaluate quality, what sources of data to use and the timing of updates
- disclosure, including whether and how to aggregate across asset classes and which metrics to use when doing so
- identifying and finding shared solutions to challenges in applying the methodology in practice
- indirect investments, such as green bonds, and how to account for their carbon footprint

6.3 Avoided emissions

Referencing section 3.4, there remains work to be done on harmonising a methodology to account for avoided emissions. Several International Financial Institutions (IFIs) have developed a methodology for quantifying the GHG impact of projects, which can also be used to calculate the avoided or 'net' emissions of, for example, renewable energy investments, investments in energy efficiency and investment in less carbon-intensive transportation solutions. Others have their own methodology for calculating the (avoided) impact of a project. In 2018, PCAF will examine the most appropriate avoided emissions calculation methodology.

6.4 Target setting

With a reference to section 2.1, PCAF's stance is that a financial institution's footprint reporting is a means to an end. The ultimate purpose is to allow steering towards a low-carbon portfolio in line with the Paris Agreement; holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change. Contributing to the development of a framework for science-based targets (SBT) could help institutions to achieve this goal.

6.5 Steering towards low-carbon portfolio

Finally, PCAF members will apply several measures to reduce the footprint of a portfolio. Below an overview of possible measures, as discussed during the PCAF meetings. It reflects ongoing work rather than a firm conclusion of PCAF.

6.5.1 Portfolio composition

One way of steering towards a low-carbon portfolio is by changing its composition. This can be achieved through divesting from certain relatively high-carbon intensity assets and replacing them with low-carbon alternatives. This can be done by applying one or more of the following measures:

- Limit exposure to high-carbon intensity assets, increase exposure to low-carbon intensity assets and green bonds
- Set a minimum low-carbon intensity assets target
- Implement a negative screen for high-carbon projects, bonds or other assets
- Explore activities that provide preferential financing conditions for low-carbon intensity assets or higher transaction costs (through reporting, monitoring and verification) for high-carbon intensity assets

6.5.2 Engagement

Another way of steering is by actively engaging with investees in order to lower their footprint. The asset or investee does not change ownership. This 'active ownership' approach can be executed through one or more of the following measures:

- Engage with investee companies or asset operators to increase energy efficiency and reduce emissions
- Engage on reducing high-carbon capital expenditure and increase climate friendly investment
- Engage on corporate GHG emission targets and strategies including disclosure and transparency

7 Glossary

Absolute emissions	Emissions attributed to an investor. Expressed in tons CO ₂ .
Avoided emissions	Emission reductions that occur outside of a product's life cycle but result from the use of that product when compared to a baseline where that product is not used
CO ₂ -equivalent (CO ₂ e)	The amount of carbon dioxide (CO ₂) that would cause the same integrated radiative forcing (a measure for the strength of climate change drivers) over a given time horizon as an emitted amount of another greenhouse gas or mixture of greenhouse gases
Corporate debt	The debt owed by a corporate entity
Direct emissions	Emissions from sources that are owned or controlled by the reporting entity and/or investee.
Double counting	Occurs when a single GHG emission reduction or removal, achieved through a mechanism issuing units, is counted more than once towards attaining mitigation pledges or financial pledges for the purpose of mitigating climate change.
Government bond	A debt security issued by a government to support government spending.
Government debt	The debt owed by a central government.
Indirect emissions	Emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.
Investment	The term "investment" (unless explicitly stated otherwise) is used in the broad sense: 'putting money into activities or organisations' with the expectation of making a profit'. This in contradiction to the more narrow definition sometimes used within for example a bank: as one of several financing options, besides e.g. debt finance, equity finance. Most forms of investment involve some form of risk taking, such as investment in equities, debt, property, projects, and even fixed interest securities which are subject to inflation risk, amongst other risks.
Project finance	The long-term financing of infrastructure and industrial projects
Relative emissions: per invested value	Emissions attributed to an investor (absolute emissions) normalised for the amount invested. Expressed in tons CO ₂ e / M€ invested.

Appendix A: Dutch Carbon Pledge

Dutch Carbon Pledge

November 28th 2015

We ask global leaders during the 21st session of the Conference of the Parties to the UNFCCC to take effective measures to keep global warming under safe levels. As financial institutions we want to take responsibility as well and come with new and meaningful steps. The annual measuring and disclosure of the carbon footprint of investments*, with the aim of using this information to identify and set carbon footprint reduction targets, is still at an early stage. Our initiative, consisting of leaders of different segments of the Dutch financial sector, intends to experiment with annual carbon foot printing, disclosure and target setting for investments. These elements are key in planning and developing investment strategies towards a low carbon society. We want to share and learn from practice and find solutions for dilemma's. We hope this will stimulate the development and adaptation of carbon foot printing and target setting in the financial sector on a larger scale for all their investments. Our goal is to form a group of leading financial institutions that cooperate in a bottom up initiative on achieving transparency and uniformity in carbon foot printing and target setting.

** investments defined in their broadest sense*



Achmea Investment Management



Appendix B: Accounting principles

Existing accounting principles

Accounting principles are the rules and guidelines that companies must follow when reporting financial data. The common set of accounting principles is the generally accepted accounting principles (GAAP). Accounting principles differ around the world, and countries usually have their own, slightly different, versions of GAAP .

GAAP includes principles on:

- Recognition; what items should be recognised in the financial statements (for example as assets, liabilities, revenues, and expenses)
- Measurement; what amounts should be reported for each of the elements included in financial statements,
- Presentation; what line items, subtotals and totals should be displayed in the financial statements and how might items be aggregated within the financial statements
- Disclosure; what specific information is most important to the users of the financial statements. Disclosures both supplement and explain amounts in the statements.

The GHG protocol identifies five GHG accounting and reporting principles in its corporate accounting and reporting standard:

- Relevance; Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.
- Completeness; Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.
- Consistency; Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
- Transparency; Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
- Accuracy; Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

For a more practical example, the ASN Bank has been footprinting their portfolio for many years and has drafted a list of nine principles from experience, with the assistance of Ecofys. These principles form the backbone of their carbon profit and loss calculations. De Volksbank has also adopted the methodology and its principles in the beginning of 2016.

- Compatibility with existing and future standards;
- Consistency between different types of investment;
- Prevention of double counting;
- Prudence
- Target setting
- Workability and level of data quality
- Reporting absolute emissions
- Allocating emissions proportionally;
- Annual accounting and reporting of emissions

Organisational boundaries and consolidation approach

As described in the GHG Protocol, first the organisational boundaries have to be defined to be able to determine which parts of the emissions from the organisation and its value chain need to be included in the carbon footprint of a company. Furthermore, the selection of a consolidation approach affects which activities in the company's value chain are categorised as direct emissions and as indirect emissions (Scope 1, 2 and 3 emissions).

In line with the GHG Protocol Corporate Standard, ASN Bank, for example, has chosen for an operational control approach, which

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means that ASN Bank accounts for all the emissions from operations over which it has control, either as Scope 1 (direct) or Scope 2 (indirect) emissions. Examples of Scope 2 emissions are emissions from electricity and heat consumption. ASN Bank invests in a lot of other organisations through different kinds of financial instruments and vehicles as part of its portfolio.

Other consolidation approaches are equity share and financial control. In the equity share approach, a company accounts for GHG emissions from operations according to the share of equity in the operation. In the financial control approach, a company accounts for GHG emissions from operations over which it has financial control. This means it does not account for GHG emissions from operations in which it owns an interest but does not have financial control. Operational control is the most frequently used consolidation approach.

The operational control approach was selected, for example, by ASN Bank because it allocates the emissions most accurately to the parties which can influence them. In addition, the operational control is flexible enough to do justice to the activities of a bank. Using the operational control approach, conventional investments, over which the bank has limited control, can be included under indirect emissions, whereas more strategic investments, such as separate entities which manage funds on the bank's behalf, can be included under direct emissions.

PCAF